المؤسسة العامة القطرية للكهرباء والماء
Qatar General Electricity & Water Corporation

CONTRACT No GTC 626/2014A

CONSTRUCTION OF MEGA RESERVOIR PRPSs
(PACKAGE A - UMM BIRKA)

CONTRACT DOCUMENTS
(VOLUME 13 OF 19)

CONSOLIDATED CONTRACTORS GROUP S.A.L. (OFFSHORE) (CCC) &
TEYSEER CONTRACTING COMPANY W.L.L.
JOINT VENTURE

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SEAH

- ► SeAH Group
- ► SeAH Steel Corporation
- ► SeAH's Pipe Plants & Records
- ► Competitiveness of SeAH Steel

SeAH Group - Overview

SěAH

► SeAH GROUP

- TOTAL SALES (USD1=KRW1,000)

  2011 : US$ 7.6 billion

  2012 : US$ 7.9 billion

  2013 : US$ 7.5 billion

SěAH

Since 1960.10.19

► RANKING IN KOREA (BY DOMESTIC REVENUE OF LISTED COMPANIES)

1st SAMSUNG

3rd HYUNDAI MOTORS

5th POSCO

9th S-OIL

29th DONG-GUK STEEL

31st SeAH

31st

- Released in April of 2013 (Private enterprises only excluding 4 Public companies)

SeAH Group - Business Fields

SěAH

MANUFACTURING

- **SeAH STEEL CORP.**
- SeAH BESTEEL
- SeAH SPECIAL STEEL
- KOREA BUNDY
- ESAB SeAH
- SeAH METAL
- SeAH E&T

IT & SERVICE

- SeAH NETWORKS
- SeAH LOGIS
- SeAH HOLDINGS

OVERSEAS

- AMERICA
- MIDDLE EAST
- ASIA
- OTHER COUNTRIES

OTHERS

- SeAH M&S
- HAIDUK STEEL
- SEDAE STEEL

► SeAH Group

► SeAH Steel Corporation

► SeAH's Pipe Plants & Records

► Competitiveness of SeAH Steel

SeAH Steel - History

SěAH

1960

'60 Establishment of Pusan Steel Pipe Ind. Co. Ltd

'65 Acquired KS Mark

'67 The first steel pipe exporter in Korea

'69 Carried out IPO

1970

'70 Seoul plant completed/ Head office relocated

'75 Renamed company 'Pusan Steel Corp.'

'78 Establishment of Pusan Pipe America

Pohang Plant went into operation

'79 Authorized to use 'API' monogram on 5L, 5CT

1980

'81 USD100 Million Export Award

Gold-Tower Industrial Award

'87 Establishment of R&D Center

1990

'90 Started Stainless Steel Pipe business

'91 Started 3 Roll Bending Steel Pipe business

'96 Company name changed to SeAH Steel Corp.

'98 Started Galvanized & Pre-painted Steel Sheet business

'99 Korea's First Duplex Stainless Steel Pipe

2000

'07 SeAH & POSCO's strategic alliance by swapping equities

'10 Establishment of SeAH Steel U.A.E. LLC.

'12 Establishment of Suncheon Plant

'13 Establishment of JCOE Plant

'14 Acquisition of Inox Tech S.P.A (Italy)

2014~

SeAH Steel - Products

SěAH

Carbon Steel Pipe

Capacity 1.7million MT/Year
Diameter ½"~197"
Thickness 1.2~128mm
Length max. 70meters

Stainless Steel Pipe & Ti Tube

Capacity 90,000MT/Year
Diameter ¼"~197"
Thickness 1.73~128mm
Length max. 30meters

Galvanized & Pre-painted Steel Sheets

Capacity 500,000MT/Year
Width 600~1300mm
Thickness 0.23~1.60mm

SeAH Steel – Usage of Our Products

SeAH

SeAH Steel - Certificates

SěAH

Certificates

ISO
KG
UIS
energy API
SA
GERMANISCHER LLOYD 1867
BUREAU VERITAS 1828
DNV
NSF
ABS
UL
RINA 1861
BUREAU VERITAS Lloyd's Register
ClassNK
NORSOK

Approved Vendor List

Shell
Saudi Aramco
Technip
ADNOC
ADPC
Abu Dhabi Water & Electricity Authority
Kuwait Oil Company
KNPC
Petroleum Development Oman
TÜV
Chevron
BH
bp
PETROL
GASCO
PETRONAS
ptt Group
ZADCO
NIGC
EIL
PEMEX
TECHINT
Eni
Saipem
SUNCOR
Canadian Natural
ADMA
TAKREER
N.I.O.C
KELLOGG

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► SeAH's Pipe Plants & Records

► Competitiveness of SeAH Steel

SeAH Steel – Domestic Operations

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Plant Head Office Port

SeAH Steel – Global Presence

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Plant Sales Office

SeAH's Pipe Plants – Lay-out

SěAH

* HFW is also known as ERW
* SRM – Stretch Reducing Mill
* SAWL – 3 Roll Bending Line(R/B)
  – Press Forming Line(JCOE)
* SAWH – Spiral Roll Forming Line

SeAH's Pipe Plants – Manufacturing Capacity in Korea

SěAH

DIVISION		O.D.	W.T.	LENGTH	CAPACITY
HFW (ERW)		½" ~ 24"	1.2~22MM	Max 21M	**1,170,000MT**
EFW (SAW)	SAWH	16" ~ 160"	6~25.4MM	Max 70M	**165,000MT**
	SAWL (3/4 ROLL)	20" ~ 56" 40" ~ 197"	Max 25.4MM Max 128MM	12.2M 4.2M	**60,000MT** **30,000MT**
	SAWL (JCOE)	18" ~ 64" 16" ~ 60"	Max 50MM Max 65MM	18.3M 13.2M	**200,000MT** **120,000MT**

ERW 1,170,000 MT + SAW 575,000 MT = TOTAL 1,745,000 MT

DIVISION		O.D.	W.T.	LENGTH	CAPACITY
GALVANIZING		½"~24"	-	8M	**120,000MT**
HFW (OCTG)	CNC THREADING	4,1/2" ~ 20"	-	13.8M	**45,000MT**
	Q/T	4,1/2 ~ 9,5/8"	-	13.8M	**60,000MT**

SeAH's Records – Production Trend in Korea

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SeAH's Records– Export Sales Ratio in Korea (2013)

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SeAH's Sales Recoras – OFFSHORE PROJECTS

SěAH

2014-05-14
(2014-1998)

COUNTRY CUSTOMER'S NAME	CONTACT PERSON	SUPPLIED PIPE DETAILS			REMARK	DATE PRODUCED
		GRADE	SIZE	Q'TY(MT)		
RUSSIA YAMAL LNG	DAVID COPAZ	A671 C60 CL22	24"~64" X 15.88~44.45MM	9,000	PROCESS PIPE	SEP. 2014
CHINA CNOOC	MR.LIU XIN ZHONG MR. NICKY PARK	X52/X56/X60/X65	8"~16" X 8.7~15.9MM	90,600	BARE PIPE OFF SHORE	1997~2010
CHINA COOEC	GAIL ZHI QUNG	X65	16" X 12.7~14.3MM	2,300	BARE PIPE OFF SHORE	2003
MEXICO DRAGADOS OFFSHORE (LITORAL CA/CB PLATFORM PJT)	MR. K.T. KIM	2B 2H50 S1,S3,S4,S5 2B A36	14"~72" 9.5MM~63.5MM	3,000	BARE PIPE OFF SHORE	MAY. 2014
VIETNAM PVC-MS	MR.HAONG	2B 2W50 S1,S3,S4,S5 5LX52L-2	930~1200mm 40~60mm	1,522	BARE PIPE OFF SHORE	MAR. 2014
PETROBRAS FPSO P74 PJT	MR.YD PARK	2B / NV E40 5L X65 PSL-2	1000MM X 50MM X 10M	273	BARE PIPE OFF SHORE	1997~2010
MEXICO DRAGADOS OFFSHORE (LITORAL CA/CB PLATFORM PJT)	MR. K.T. KIM	2B 2H50 S1,S3,S4,S5 2B A36	14"~72" 9.5MM~63.5MM	16,000	BARE PIPE OFF SHORE	SEP. 2013
USA RISER	MR. PETER SONG	API X80 PSL2	21"/26" 15.9MM~25.4MM	350	BARE PIPE OFF SHORE	AUG. 2013
MEXICO BOSNOR (KUIL-B PLATFORM PJT)	MR. S.W. KIM	2B 2H50 S1,S3,S4,S5 2B A36	14"~64" 9.5MM~63.5MM	3,850	BARE PIPE OFF SHORE	AUG. 2013
MEXICO CARSO (XANAB-B PLATFORM PJT)	MR. S.W. KIM	2B 2H50 S1,S3,S4,S5 2B A36	14"~30" 12.7MM~31.8MM	348	BARE PIPE OFF SHORE	AUG. 2013
PERTAMINA PHE UL PJT	MR.SW NAM	2B / API 2H GR.50, A572 GR.50/ A36	30" X 1.5" X 40FT	317	BARE PIPE OFF SHORE	JUNE. 2013
MEXICO CARSO (KU-B, AYASIL-A, EK-A2)	MR. SWKIM	2B 2H50 2B A36	14"~72" X 9.5MM~63.5MM	8,900	BARE PIPE OFF SHORE	SEPT., 2012
EGYPT ABU QIR PETROLEUM	MR.Y.G SHIM	X65L2	16"X17.5	4,700	BARE PIPE OFF SHORE	SEPT., 2011
PERU SAVIA PERU	MR. KENNETH KIM	X42/X52 2H50	3.1/2"~70" X 6.4~63.5	4,400	BARE/COATED PIPE OFF SHORE	AUG., 2011

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► SeAH Steel Corporation

► SeAH's Pipe Plants & Records

► Competitiveness of SeAH Steel

Explore Further, Heavier & Deeper!

- Max. 18M Length with Cold Expander (JCOE)
- Max. 128mm W.T. (Roll Bending)
- Max. 70M Length with accessory (Spiral)

Make your step profitable!

Having Satisfactory Solution

- A Variety of Products (JCOE, Roll Bending & Spiral)
- 995,000 MT SAW Capacity Per Annum Including SSU, USP
- 1,170,000 MT Additional ERW Capacity

Go beyond your limit with diverse options

SeAH

With Reliability

- Over 50 Years of History
- Running R&D Center for High-end Products
- Quality Management System thru ERP & SAP

For your trust, SeAH sells its pride

SeAH Steel Can Be...

SěAH

Thank you

Quality Management Manual

Document No.	:	SAS-QM-100
Established Date	:	Jan. 20, 2008
Rev. No.	:	07
Rev. Date	:	Jan.02, 2013

Approved by Hwi-Ryeong Lee

President

Reviewed by Sung-Jin Kim

QM Team G. Manager

Prepared by Han-Taek Seo

QM Team

Address: BL 3, Yulchon 1st industrial complex, Sinseong-ri, Haeryong-myeon, Suncheon-City, Jeon-nam, Korea

Tel:+82-61-760-2400 Fax: +82-61-726-7788

SeAH Steel Corporation

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Foreword

Since 1960, our company, SeAH Steel Corp. has been established and has been producing tubular products, and is continuously developing the best products to meet the Customer demands.

SeAH Steel Corp. Suncheon Plant is dedicated to deliver the better quality products and the excellent services to our customer. In order to meet the customers further expectation and endless development under the systematical quality management, Our Company prepared this Quality Management Manual based on ISO 9001:2008, API Q1 (8th) and ISO/TS 29001:2007 Specification.

This manual prescribes Quality Management System and its related processes implementation requirements arising from producing of Steel Pipes in our company.

Quality Policy

1. SeAH Steel Corp. has the following quality policy for the operation of quality management system.

    1. REALIZATION OF CUSTOMER SATISFACTION
    2. CONTINUAL IMPROVEMENT OF QUALITY MANAGEMENT SYSTEM
    3. OBSERVANCE OF STANDARDS

2. Above policy shall be accordance with related laws, and CEO of SeAH Steel Corp. guarantees quality system and quality policy recognized everywhere in the company to accomplish quality policy.

3. Manager of Q.M team, who is a management representative, should teach all members to understand quality policy and should build up and execute concrete quality objective for accomplishment of quality policy, on the other hand, the members should do their best to efficiently operate quality management system and to accomplish quality objective.

4. Quality policy should go public to guarantee the willingness and fairness of quality management, and if necessary, open to the public and the persons concerned interests.

Jan. 01, 2013

Representative director (President)

SeAH Steel Corporation

1. Scope and Application

This manual has the basic requirements of our Company's Quality Management System and defines each required processes implementation methods. This manual requirements shall be applied to all business area of our Company. This manual is the first tier document of our Company, and no other documents in our Company shall supersede this manual meaning.

2. Normative Reference

. API Q1 (8th): 2007- Specification for Quality Programs for the Petroleum, Petrochemical and Natural Gas Industry

. TS 29001:2007- Petroleum, Petrochemical and Natural Gas Industry-Sector specific requirements

. ISO 9001:2008- Requirements for product and service supply organizations

3. Terms and Definition

3.1 General

ISO 9000:2005 terms and definitions are used. This Manual description for supply chain is;

Supplier ⟶ **Organization** ⟶ **Customer**

. Supplier: The persons or organizations of supplying raw material or services
. Organization: Our Company
. Customer: The persons or other organizations of receiving the products or services by our Company

Abbreviations;
QMS: Quality Management System
Company: Our Company (SeAH Steel Corp.)

3.2 Quality Management System Method

Company adapts PDCA model as the controlling method for all related control processes in QMS, and pursues the continual improvement of all processes
The basement of every processes are as Figure 1.

Fig. 1 Model of Process Based QMS

4. Quality Management System

4.1 General Requirements
Company shall establish, document, implement and maintain a QMS and continually improve its effectiveness in accordance with API Spec Q1:2007 and ISO 9001:2008 standards.

Company shall,
a. determine the processes needed for the quality system and their application throughout Company,
b. determine the sequence and interaction of these processes,
c. determine criteria and methods needed to ensure that both the operation and control of these processes are effective,
d. ensure the availability of resources and information necessary to support the processes operation and monitoring,
e. monitor, measure where applicable and analyze these processes, and
f. implement actions necessary to achieve planned results and continual improvement of these processes.

These processes shall be managed by Company in accordance with the requirement of API Q1 and ISO 9001:2008 Specification.

Where Company chooses to outsource any processes that affect products conformity to requirements, Company shall ensure control over such processes. The type and extent of control to be applied to these Outsourced processes shall be defined within the quality management system.

4.1.1 Out-Sourced Processes and/or Services of Company
Out sourced processes of Company are;
1. Non-Destructive Examination
2. Monitoring and Measuring Equipment Calibration(if required by customer)
3. Test and Analysis (if required by customer)
4. Manufacture Service (if required)

Company shall maintain responsibility for product conformance to specified requirements when processes are outsourced.

4.1.2 QMS Exclusion and its justification
Company excludes "Design and Development Process" stated in Section 7.3 of ISO 9001:2008 and API Q1 specifications, because it isn't applied to our system

4.2 Documentation Requirements
4.2.1 General
The QMS documentation of Company shall include
a. documented statements of a Quality Policy and Quality Objectives,
b. a Quality Manual,
c. documented procedures and records required by API Q1 standard
d. documents, including records, determine by the company to be necessary to ensure the effective planning, operation and control of its processes.

4.2.2 Quality Manual

Company shall establish and maintain a quality manual that includes
a. the scope of the QMS, including details of and justification for any exclusions (see **4.1.2**),
b. the documented procedures established for the QMS or reference to them (see **Appendix 1**)
c. a description of the interaction between the processes of the QMS (see **Appendix 2**)

4.2.2.1 Quality Manual-supplemental
Company manual shall identify the manner in which Company addresses each specific requirement of API Q1 specification, including both the requirements of ISO 9001:2008 and the supplemental requirements.

4.2.3 Control of Documents
Documents required by the QMS shall be controlled by Company. Records are a special type of document and shall be controlled according to the requirements given in **4.2.4**.

A documented procedure shall be established to define the controls needed
a. to approve documents for adequacy prior to issue,
b. to review and update as necessary and re-approve documents,
c. to ensure that changes and the current revision status of documents are identified,
d. to ensure that relevant versions of applicable documents are available at points of use,
e. to ensure that documents remain legible and readily identifiable,
f. to ensure that documents of external origin determined by the company to be necessary for the planning and operation of the quality management system are identified and their distribution controlled, and
g. to prevent the unintended use of obsolete documents, and to apply suitable identification to them if they are retained for any purpose.

4.2.3.1 Control of documents-Supplemental
A master list or equivalent control feature shall be used to identify the documents required by the QMS, and their current revision status.

4.2.3.2 Control of document changes-Supplemental
Changes to documents shall be reviewed and approved by the same functions that performed the original review and approval.

4.2.4 Control of Records
Records established to provide evidence of conformity to requirements and of the effective operation of the QMS shall be controlled.
The company shall establish a documented procedure to define the controls needed for identification, storage, protection, retrievable, retention time and disposition of records.
Records shall remain legible, readily identifiable and retrievable.

4.2.4.1 Control of Records-Supplemental
The documented procedure shall identify the functions responsible for the collection and maintenance of records. Records required by applicable industry product standards shall be retained for not less than the period of time specified by the industry standard or five years, whichever is longer. Records required to provide evidence of conformity to requirements and of the effective operation of the QMS shall be retained for a minimum of five years.

5. Management Responsibility

5.1 Management Commitment
Top management shall provide evidence of its commitment to development and implementation of the QMS and continually improving its effectiveness by,
a. communicating to Company the importance of meeting customer as well as statutory and regulatory requirements,
b. establishing the quality policy,
c. ensuring that quality objective are established,
d. conducting management reviews, and
e. ensuring the availability of resources.

5.2 Customer Focus
Top management shall ensure that the customer requirements are determined and are met with the aim of enhancing customer satisfaction.

5.3 Quality Policy
Top manager shall ensure that the quality policy
a. is appropriate to the purpose of the organization,
b. includes a commitment to comply with requirements and continually improve the effectiveness of the QMS,
c. provides a frame work for establishing and reviewing quality objectives,
d. is communicated and understood within Company, and
e. is reviewed for continuing suitability.

5.3.1 Quality Policy -Supplemental
Top manager shall document its approval of the quality policy

5.4 Planning
5.4.1 Quality Objective
Top management shall ensure that quality objective, including those needed to meet requirements for product are established at relevant functions and levels within Company. The quality objectives shall be measurable and consistent with the quality policy.

5.4.2 QMS planning
Top management shall ensure that
a. the planning of the QMS is carried out in order to meet the requirements given in **4.1**, as well as the quality objective, and
b. the integrity of the QMS is maintained when changes to the QMS are planned and implemented.

5.5 Responsibility, Authority and Communication
5.5.1 Responsibility and Authority
Top management shall ensure that responsibilities and authorities are defined and communicated within Company. The Basic responsibilities of each function of Company is **Table 1-1**.
The detail of assigned responsibilities and authorities of each function of Company is filled in the Job-Assignment form. It shall be approved by top management.

Table1-1; Responsibility of Each Team. Remark: ●–Responsibility ○—Related

Function SeAH Steel Corp., Suncheon Plant / QMS Section		President	Management Representative	QM	Production	Facility	Logistics	Administration (Procurement)	Sales
4.1	General Requirement	●	○	○	○	○	○	○	○
4.2	Documentation Requirement	○	○	●	○	○	○	○	○
5.1	Manage Commitment	●	○	○	○	○	○	○	○
5.2	Customer Focus	●	○	○	○	○	○	○	○
5.3	Quality Policy	●	○	○	○	○	○	○	○
5.4	Planning	●	○	○	○	○	○	○	○
5.5	Responsibility, Authority and Communication	●	○	○	○	○	○	○	○
5.6	Management review	●	○	○	○	○	○	○	○
6.1	Provision of Resources	●	○	○	○	○	○	○	○
6.2	Human Resources	○	○	○	○	○	○	●	○
6.3	Infra structure	●	○	○	○	○	○	○	○
6.4	Working environment	○	●	○	○	○	○	○	○
7.1	Planning	●	○	○	○	○	○	○	○
7.2	Customer Related Process	●	○	●	○	○	●	○	●
7.3	Design and Development	**Valid Exclusion of QMS**							
7.4	Purchasing	○	○	○	○	○	○	●	○
7.5	Product and Service Provision	○	○	○	●	●	●	○	○
7.6	Control of Monitoring and Measuring Devices	○	○	●	○	○	○	○	○
8.1	General	○		●	○	○	○	○	○
8.2	Monitoring and Measurement	○	○	●	○	○	○	○	○
8.3	NCR Product Control	○	○	●	○	○	○	○	○
8.4	Analysis of Data	○	○	●	○	○	○	○	○
8.5	Improvement	●	○	○	○	○	○	○	○

5.5.2 Management Representative

Management Representative is appointed by top Management as a member of management who, irrespective of other responsibilities, shall have responsibility and authority that includes

a. ensuring that processes needed for the QMS are established, implemented and maintained,
b. reporting to Top Manager on the performance of the QMS of Company and any need for improvement, and
c. ensuring the promotion of awareness of customer requirements throughout Company.

Management Representative of our company is QM team manager.

5.5.3 Internal Communication

Top management shall ensure that appropriate communication processes are established within Company and that communication takes place regarding the effectiveness of the QMS.

5.6 Management Review
5.6.1 General
Top Management shall review Company QMS, at prescribed intervals, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the QMS, including the quality policy and objectives.
Records from management review shall be maintained.

5.6.1.1 General-Supplemental
The management review shall be conducted at least annually and shall include monitoring of quality objectives as a part of the review result.

5.6.2 Review input
The input of management review shall include information on
a. suitability and realization of quality policy and objectives,
b. results of internal and external audits,
c. customer feedback,
d. process performance and product conformity in conjunction with 8.4 c. includes trends of product non-conformity and reports and analysis of field nonconformities, if applicable,
e. status of preventive and corrective actions,
f. follow-up actions from of the previous management review,
g. changes that could affect Company QMS includes changes to applicable petroleum, petrochemical and natural gas industry standards,
h. recommendations for improvement,

5.6.3 Review output
Out- put from the management review shall include any decisions and actions related to
a. improvement of the effectiveness of Company QMS and its processes.
b. improvement of product related to customer requirement, and
c. resource needs.

6. Resource Management

6.1 Provision of resources
Company shall determine and provide the resources needed
a. to implement and maintain Company QMS and continually improve its effectiveness, and
b. to enhance customer satisfaction by meeting customer requirements.

6.2 Human Resources
6.2.1 General
Personnel performing work affecting conformity to product requirements shall be competent on the basis of appropriate education, training, skills and experience.

6.2.2 Competence, awareness and training
Company shall
a. determine the necessary competence for personnel performing work affecting product conformity to product requirements
b. where applicable, provide training or take other actions to achieve the necessary competence,
c. evaluate the effectiveness of the action taken,
d. ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives and,
e. maintain appropriate records of education, training, skills and experience.

6.2.2.1 Training-Supplemental
QA/QC Team shall establish control features for identifying training needs and providing for training of personnel who perform activities addressed in QMS. The training requirements shall provide for QMS training and for job training of personnel. The frequency of training shall be defined.

6.3 Infrastructure
6.3.1 Organizational Structure
Top management shall ensure that this organizational structure is effective for the implementation of QMS and its processes.
Company organizational structure is as following Fig. 2.

6.3.2 Other infrastructure required
Top Management shall determine, provide and maintain the infrastructure needed to achieve conformity to product requirements. Infrastructure includes, as applicable
a. building, workspace and associated utilities,
b. process equipment (both hardware and software), and
c. supporting services (such as transport or communication or information system)

6.4 Working environment
Company shall determine and manage the work environment needed to achieve conformity to product requirements. It includes maintaining Company in a state order, cleanliness and repair consistent with the product and manufacturing process needs.

Fig. 2 Organizational Structure of Company

7. Product Realization

7.1 Planning of product realization
Company shall plan and develop the processes needed for product realization planning of product realization shall be consistent with the requirement of the other processes of Company QMS.

In planning product realization, Company shall determine the following, as appropriate:
a. quality objectives and requirements for the product;
b. the need to establish processes, and documents, and to provide resources specific to the product;
c. required verification, validation, monitoring, measurement, inspection and test activities specific to the product and the criteria for product acceptance;
d. records needed to provide evidence that the realization processes and resulting product meet requirements.

The out -put of this planning shall be in a form suitable for Company's method of operation.

7.1.1 Planning of product realization-Supplemental
When product requirements are provided from the external sources, Company shall define the methods and shall establish control features used to translate these requirements into the product realization process.

7.2 Customer-related processes
7.2.1 Determination of requirements related to the product
Company shall determine
a. requirements specified by the customer, including the requirements for delivery and post-delivery activities,
b. requirements not stated by the customer but necessary for specified or intended use where known
c. statutory and regulatory requirements applicable to the product, and
d. any additional requirements considered necessary by the Company.

7.2.2 Review of requirements related to the product
Company shall review the requirement related to the products. This review shall be conducted prior to Company's commitment to supply the products to the customer, (e.g. submission of tender, acceptance of contract or orders, acceptance of changes to contracts or orders) and shall ensure that
a. product requirements are defined;
b. contract or order requirements differing from those previously expressions are solved;
c. Company has the ability to satisfy the defined requirements.

Records of the results of the review and actions arising from the review shall be maintained.
Where the customer provides no documented statement of requirements they shall be confirmed by Company before acceptance.
Where product requirement are changed, Company shall ensure that the relevant documents are amended and that relevant personnel are made for aware of the changed requirements.

7.2.2.1 Review of requirement related to the product-Supplemental
Company shall establish control features to review requirements related to the product.

7.2.3 Customer communication
Company shall determine and implement effective arrangements for communicating with customers in relation to

a. product information
b. enquires, contracts or order handling amendments, and
c. customer feedback, including customer complaints.

7.3 Design and development
This section requirement is valid exclusion (see **4.1.2**).

7.4 Purchasing
7.4.1 Purchasing process
Company shall ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product.
Company shall evaluate and select suppliers based on their ability to supply product in accordance with Company requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained.

7.4.1.1 Purchasing process-Supplemental
Company shall establish control features for the purchasing process and supplier selection.
7.4.1.2 Criteria for supplier selection, evaluation and re-evaluation-Supplemental
Criteria for the selection, evaluation and re-evaluation of suppliers shall include one or more the following.
a. inspection of supplier's final product by Company at supplier's facility.
b. inspection of supplier's final product by Company upon delivery.
c. surveillance of supplier's conformance to Company purchasing requirements.
d. verification by Company that the supplier's QMS conforms to an internationally recognized QMS standard/technical specification.

7.4.1.3 Supplier provided processes that require validation-Supplemental
Where Company chooses to outsource any process that requires validation (see **4.1.1**), Company shall require that the supplier comply with the requirements of 7.5.2, as applicable.

7.4.2 Purchasing information
Purchasing information shall be described the product to be purchased, including where appropriate
a. requirements for approval of product, procedures, processes and equipment,
b. requirements for qualification of personnel, and
c. QMS requirements.

Company shall ensure the adequacy of specified purchase requirements prior to their communication to the supplier.

7.4.2.1 Purchasing information-Supplemental
Purchasing information provided to the supplier shall be documented and shall describe the product to be purchased, including where appropriate the items in **7.4.2** as well as:

a. the type, class, grade or other precise identification, and
b. the title or other positive identification, and applicable issues of specifications, drawings, process requirements, inspection instructions and other relevant technical data.

7.4.3 Verification of the purchased product
Company shall establish and implement the inspection or other activities necessary for ensuring that

purchased product meets specified purchase requirements.
Where Company and its customer intend to perform verification at the supplier's premises, Company shall state the intended verification arrangements and methods of product release in the purchasing information.

7.4.3.1 Verification of purchased product-Supplemental
Company shall establish control features for the verification of purchased products and shall maintain records of verification activities.

7.5 Production and service provision
7.5.1 Control of production and service provision
Company shall plan and carry out production and service provision under controlled conditions.
Controlled conditions shall include, as applicable
a. the availability of information that describes the characteristics of the product,
b. the availability of work instructions as necessary,
c. the use of suitable equipment,
d. the availability and use of monitoring and measuring equipment,
e. the implementation of monitoring and measurement, and
f. the implementation of product release, delivery and post delivery activities.

7.5.1.1 Control of production and service provision-supplemental
Company shall establish control features that describe the control of production and service activities performed.

7.5.1.2 Process control-supplemental
Process Control shall be documented in routing, travelers, checklist, process sheets, or other type of control features and shall include requirements for verifying compliance with the quality plans, control features, and reference standards/codes. The process control documents shall include or reference instructions, workmanship and acceptance criteria for process, tests, inspections and customer's inspection hold or witness points.

7.5.2 Validation of processes for production and service provision
Company shall validate any processes for production and service provision where the result output can not be verified by subsequent monitoring or measurement and as a consequence, deficiencies become apparent only after the product is in use or the service has been delivered.
validation shall demonstrate the ability of these processes to achieve planned results.

Company shall establish arrangements for these processes including, as applicable
a. defined criteria for review and approval of the processes,
b. approval of equipment and qualification of personnel,
c. use of specific methods and procedures,
d. requirements for records, and
e. revalidation

7.5.2.1 Validation of processes for production and service provision-Supplemental
Company shall validate those processes identified by the applicable product specification as requiring validation. If these processes are not identified, or there is no product specification involved, the processes requiring validation shall include, as a minimum, forming, NDE, Welding and Heat Treating,

if applicable to the product. **Company**'s validation required processes are forming, Welding, NDE and Heat Treatment.

7.5.3 Identification and Traceability
Where appropriate, Company shall identify the product by suitable means throughout product realization. Company shall identify the product status with respect to monitoring and measurement requirements throughout product realization.
Where traceability is a requirement, Company shall control and record the unique identification of the product and maintain records.

7.5.3.1 Identification and traceability-Supplemental
Company shall establish control features for identification and traceability of the product by suitable means from receipt and during all stages of production, delivery and installation, as required by Company, the customer and the applicable product specifications.

7.5.3.2 Identification and traceability maintenance and replacement-Supplemental
Control features shall include requirements for maintenance or replacement of identification and traceability marks and records.

7.5.3.3 Product status-Supplemental
Company shall establish control features for the identification of product status.

7.5.3.4 API monogram application
When Company is providing an API monogrammed product, conformance with API specified requirements, described in API Specification Q1, including Annex A, Company shall follow API stated requirements.

a. Company shall develop and maintain the API monogram marking procedure that documents the marking/monogramming requirements specified by the API product specification to be used for application of the API monogram . The marking procedure shall define the location(s) where Company shall apply the API monogram and require that Company license number and date of manufacture be marked on monogrammed products in conjunction with the API monogram. At a minimum, the date of manufacture shall be two digits representing the month and two digits representing the year unless otherwise stipulated in the applicable API product specification. Where there are no API product specification marking requirements, Company shall define the location(s) where this information is applied.
b. API monogram shall be applied before delivery after final acceptable notification by Company and shall be removed in accordance with API monogram marking procedure if the product is subsequently found to be non-conforming with API specified requirements. Products that do not conform to API specified requirements shall not bear the API monogram..
c. When Company applies API monogram, Company shall keep the current API specification requirement which are detailed in API Policy document, Monogram marking requirement, and relevant control procedure.
d. API monogram shall be applied at Company premises.
e. The authority and responsible for applying and removing the API monogram shall be defined in API monogram marking control procedure.
Any proposed change to Company quality program, to a degree requiring changes to the Quality manual, shall be submitted to API for acceptance prior to incorporation into Company QMS.

Company shall not use the API monogram on letterheads or in advertising (including Company sponsored website) without an express statement of fact describing the scope of Company authorization (license number).

7.5.4 Customer property
Company shall exercise care with customer property while it is under Company's control or being used. Company shall identify, verify, protect and safeguard customer property provided for use or incorporation into the product. If any customer property is lost, damaged or otherwise found to be unsuitable for use, this shall be reported to the customer and records maintained.

7.5.4.1 Customer Property-Supplemental
Company shall establish control features for the verification, storage, maintenance and control of customer property.

7.5.5 Preservation of product
Company shall preserve the conformity of product during processing and delivery to the intended destination in order to maintain conformity to requirements. As applicable preservation shall include identification, handling, packaging, storage and protection. Preservation shall also apply to the constituent parts of a product.

7.5.5.1 Preservation of product-supplemental
Company shall establish control features describing the methods used to preserve the conformity of products for the activities of **7.5.5**

7.5.5.2 Periodic assessment of stock-Supplemental
In order to detect deterioration, the condition of product or constituent parts in stock shall be assessed at specified intervals.

7.6 Control of monitoring and measuring equipment
Company shall determine the monitoring and measurement to be undertaken and the monitoring and measuring equipment needed to provide evidence of conformity of product to determined requirements. Company shall establish processes to ensure that monitoring and measurement can be carried out in a manner that is consistent with the monitoring and measurement requirements.

Where necessary to ensure valid results measuring equipment shall,
a. be calibrated or verified or both at prescribed intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded;
b. be adjusted or re-adjusted as necessary;
c. have identification in order to determine its calibration status;
d. be safeguarded from adjustments that would invalidate the measurement result;
e. be protected from damage and deterioration during handling, maintenance and storage.

In addition, Company shall assess and record the validity of the precious measuring results when the equipment is found not to conform to requirements. Company shall take appropriate action on the equipment and any product affected. Records of the results of calibration and verification shall be maintained.

When used in the monitoring and measurement of specified requirements, the ability of computer software to satisfy the intended application shall be confirmed. This shall be undertaken prior to initial use and reconfirmed as necessary.

7.6.1 Company shall establish control features to control, calibrate and maintain monitoring equipment. control feature shall include equipment type, unique identification, location, frequency of check, check method, and acceptance criteria.

7.6.2 Company shall ensure that the environmental conditions are suitable for calibration, inspections, measurements and tests being carried out.

7.6.3 Records of the calibration/verification activity for all gauges, measuring and test equipment, needed to provide evidence of conformity of product to determined requirements including employee and customer owned equipment shall include,

a. equipment identification, including the measurement standard against which the equipment is calibrated.
b. revisions following engineering changes,
c. any out-of-specification readings as received for calibration/verification,
d. an assessment of the impact of out-of-specification condition, and
e. notification to the customer if suspected product or material has been shipped.

8. Measurements, Analysis and Improvement

8.1 General

Company shall plan and implement the monitoring, measurement, analysis and improvement process needed

a. to demonstrate conformity to product requirements,
b. to ensure conformity of the QMS, and
c. to continually improve the effectiveness of the QMS

This shall include determination of applicable methods, including statistical techniques, and the extent of their use.

8.2 Monitoring and measurement

8.2.1 Customer satisfaction

As one of the measurements of the performance of the QMS, Company shall monitor information relating to customer perception as to whether Company has met customer requirements. The methods for obtaining and using this information shall be determined.

8.2.2 Internal audit

Company shall conduct internal audit at planned intervals to determine whether the QMS

a. conforms to the planned arrangement, to the requirements of API Q1 and to the QMS requirements established by Company, and
b. is effectively implemented and maintained.

An audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audit. The audit criteria, scope, frequency and methods shall be defined. The selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process. Auditors shall not audit their own work.

A documented procedure shall be established to define the responsibilities and requirements for planning and conducting audits, establishing records and recording results.
Records of the audits and their results shall be maintained.

Company is responsible for the area being audited shall ensure that any necessary corrections and corrective actions are taken without undue delay to eliminate detected nonconformities and their causes. Follow up activities shall include the verification of the action taken and the reporting of verification results.

8.2.2.1 Internal audit-Supplemental
Internal audit shall be scheduled and conducted at least annually by the personnel independent of those who performed or directly supervised the activity being audited.

8.2.2.2 Response time-Supplemental
Response time for addressing detected nonconformities shall be identified.

8.2.3 Monitoring and measurement of processes
Company shall apply suitable methods for monitoring and, where applicable, measurement of the QMS processes. These methods shall demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, correction and corrective action shall be taken, as appropriate. Company shall maintain records the effective date of process changes.

8.2.4 Monitoring and measurement of products
Company shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process In accordance with the planned arrangements.

Evidence of conformity with the acceptance criteria shall be maintained. Records shall indicate the person(s) authorizing release of product for delivery to the customer.

Product release and service delivery to the customer shall not proceed until the planned arrangement have been satisfactory completed, unless otherwise approved by the relevant authority and, where applicable, by the customer.

8.2.4.1 Monitoring and measurement of product-Supplemental
Company shall establish control features to monitor and measure the characteristics of the products.

8.2.4.2 Acceptance inspection-Supplemental
Personnel other than the persons who performed or directly supervised the production of products shall perform final acceptance at planned stages of the product realization process.

8.3 Control of nonconforming product
Company shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use of delivery. A documented procedure shall be established to

define the controls and related responsibilities and authorities for dealing with nonconforming product.

Where applicable, company shall deal with nonconforming product by one or more of the following ways:
a. by taking action to eliminate to detected nonconformity;
b. by authorizing its use, release or acceptance under concession by a relevant authority and, where applicable, by customer;
c. by taking action to preclude its original intended use or application.
d. by taking action appropriate to the effects, or potential effects, of the nonconformity when nonconforming product is corrected after delivery or use has started.

When nonconforming product is corrected it shall be subjected to re-verification to demonstrate conformity to the requirements.

Records of the nature of nonconformities and any subsequent action taken, including concessions obtained, shall be maintained.

8.3.1 Release or acceptance of nonconforming product –Supplemental
The process of evaluation, release and acceptance of nonconforming product shall include one or more following.
a. Accepting products that do not satisfy manufacturing acceptance criteria provided that
- products satisfy the design acceptance criteria,
-the violated manufacturing acceptance criteria are categorized as unnecessary to satisfy the designed acceptance criteria or,
- products are repaired or reworked to satisfy the design acceptance criteria or manufacturing acceptance criteria;
b. Accepting products that do not satisfy the original design acceptance criteria provided that
- the original design acceptance criteria are changed per 7.3.7;
- the material or products satisfy the new design acceptance criteria.

8.3.2 Field nonconformity analysis-Supplemental
The documented procedure for nonconforming product shall include requirements for identifying, documenting and reporting incidents of field nonconformities or product failures. The documented procedure shall ensure that analysis of field nonconformities, provided the product or documented evidence supporting the nonconformity is available to facilitate the determination of the cause.

8.3.3 Customer notification-Supplemental
Company shall notify customers in the event that product which does not conform to design acceptance criteria has been delivered. Company shall maintain records of such notifications

8.4 Analysis of data
Company shall determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the QMS and to evaluate where improvement of the effectiveness of the QMS can be made. This shall include data generated as a result of monitoring and measurement and from other relevant sources.

The analysis data shall provide information relating to
a. customer satisfaction
b. conformity to product requirements,
c. characteristics and trends of processes and products including opportunities for preventive action, and
d. suppliers.

8.4.1 Analysis of data-Supplemental
Company shall establish control features for the identification and use of the techniques for the analysis of data.

8.5 Improvement
8.5.1 Continual improvement
Company shall continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.

8.5.2 Corrective action
Company shall take action to eliminate the causes of nonconformities in order to prevent recurrence. corrective actions shall be appropriate to the effectives of the nonconformities encountered.

A documented procedure shall be established to define requirements for

a. reviewing nonconformities (including the customer complaints),

b. determining the cause of nonconformities,
c. evaluating the needs for action to ensure that nonconformities do not recur,
d. determining and implementing action needed,
e. records the results of action taken, and
f. reviewing the effectiveness of the corrective action taken.

8.5.2.1 Corrective action –Supplemental
Company shall ensure that any corrective action is effective.

8.5.2.2 Response times-Supplemental
Company shall identify response time for addressing corrective action.

8.5.3 Preventive action

Company shall determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive action shall be appropriate to the effects of the potential problems.

A documented procedure shall be established to define requirements for

a. determining potential nonconformities and their causes,
b. evaluating the need for action to prevent occurrence of nonconformities,
c. determining and implementing action needed,
d. records of results of action taken, and
e. reviewing the effectiveness of preventive action taken.

8.5.3.1 Preventive action-Supplemental
Company shall ensure that any preventive action is effective.

Appendix 1. Related Control Procedure List

SAS-QP-A102	Management Review Procedure
SAS-QP-B201	Document and data Control Procedure
SAS-QP-B202	Quality Record Control Procedure
SAS-QP-B301	Training and Indoctrination Procedure
SAS-QP-C101	Purchasing Procedure
SAS-QP-C102	Supplier Evaluation Procedure
SAS-QP-C103	Subcontracted Service Control Procedure
SAS-QP-D101	Contract Review Procedure
SAS-QP-D201	Customer Satisfaction Control Procedure
SAS-QP-D202	Customer property Control Procedure
SAS-QP-D203	Customer's Complaint Control Procedure
SAS-QP-E101	Production Process Control Procedure
SAS-QP-E102	Special Process Monitoring Procedure
SAS-QP-E103	WPS Preparation and Qualification Procedure
SAS-QP-E104	Product Status Control Procedure
SAS-QP-E105	Handling, Storage & Shipping Procedure
SAS-QP-E106	Forming Process Qualification Procedure
SAS-QP-E201	Identification and Traceability Control Procedure
SAS-QP-E202	Welding Consumable Control Procedure
SAS-QP-E301	Production Facility Control Procedure
SAS-QP-E401	Welder & Welding Operator Qualification Procedure
SAS-QP-E402	Heat Treatment Operator Qualification Procedure
SAS-QP-F101	Product Monitoring & Measuring Control Procedure
SAS-QP-F102	Monitoring and Measuring Device Control Procedure
SAS-QP-F103	Certification of Inspector and Test Personnel Procedure
SAS-QP-F104	Non-conforming Product Control Procedure
SAS-QP-F105	Data Analysis Control Procedure
SAS-QP-F201	Internal Audit Procedure
SAS-QP-F202	Auditor Qualification Procedure
SAS-QP-F203	Corrective And Preventive Action Control Procedure
SAS-QP-F205	Continual Improvement Control Procedure

Appendix 2. Management Review Process and it's QMS Interface

Appendix 3. Internal Audit Process and its QMS interface

Appendix 4. Product Realization Process and its QMS interface

Appendix 5. Human Resources Control Process and its QMS Interface

SHE MANUAL

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SeAH	SHE MANUAL	Sec. No. Rev. Page	1.1 0 1/1
	INDEX	Date	2012. 3. 5.

TITLE	Page	Date of Actment (Y-M-D)	Rev.No	Final Revision date (Y-M-D)
1.1 Index	1	2012. 3. 5.	0	
1.2 Revision Status	1	2012. 3. 5.	0	
2.1 SHE Manual Management	1	2012. 3. 5.	0	
3.1 Definition	3	2012. 3. 5.	0	
4.1 SHE Policy	3	2012. 3. 5.	0	
4.2 Risk Assessment	3	2012. 3. 5.	0	
4.3 Environmental Aspects	3	2012. 3. 5.	0	
4.4 Legal & other Requirements	2	2012. 3. 5.	0	
4.5 SHE Objectives	2	2012. 3. 5.	0	
4.6 SHE Management Program	2	2012. 3. 5.	0	
4.7 Organization &Responsibility	7	2012. 3. 5.	0	
4.8 Training, Awareness & Competence	2	2012. 3. 5.	0	
4.9 Communications	2	2012. 3. 5.	0	
4.10 SHE Documentation	4	2012. 3. 5.	0	
4.11 Control of Document	3	2012. 3. 5.	0	
4.12 Operational Control	2	2012. 3. 5.	0	
4.13 Emergency Preparedness & Response	2	2012. 3. 5..	0	
4.14 Monitoring & Measurement	2	2012. 3. 5.	0	
4.15 Corrective & Preventive action	2	2012. 3. 5.	0	
4.16 Control of Records	2	2012. 3. 5.	0	
4.17 Internal Audit	2	2012. 3. 5.	0	
4.18 Management Review	2	2012. 3. 5.	0	

Revision Status			Date	2012. 3. 5.
Rev. No.	Sec. No.	Revision Status	Date	Rev. No.
0	1.1 ~ 4.18	SHE Manual is established on 18 Items in accordance to OHSAS 18001, KOSHA 18001, and ISO 14001 Requirements.	2012.3.5.	0

SeAH	SHE MANUAL	Sec.No.	2.1
		Rev.	0
		Page	1/1
SHE Manual Management		Date	2012. 3. 5.

1. Scope of Application

This SHE Manual shall implement for all departments at Seah corporation Pohang plant.

2. Establish, Revision

SHE Manual shall be reviewed every year by people appointed by Safety & Environment Team and the following elements shall be reflected and revised when needed.

1) Reflection of present SHE management policy
2) Change contents of SHE policy and Objectives
3) Change contents of SHE related Regulations and Requirements agreed by organization
4) Revision Contents needed by Manager of Safety & Environment Team (OHSAS 18001, KOSHA 18001 & ISO 14001 requirements etc)

3. Approval

SHE Manual shall be drawed, reviewed and approved by as followed people.

Draw U. G. Yoo
SHE Manual Manager

Review J. G. HWANG
Manager of Safety & Environment Team

Approval J. W. HA
Plant Manager

Final Approval
Representative Director(President)

1. Scope of Application

Terms used in this SHE manual are followed by OHSAS 1800, KOSHA 18001 and ISO 14001 standard. Terms in no standard are followed by applicable standard in corporation or related regulations.

2. Definition of Terms

2.1 SHE Management System

Whole management system's section including organization's structure, plan activity, responsibility, practice, procedure, process and resources to develop, implement, achieve, review and maintain SHE policy

2.2 SHE Policy

Statement by the organization of its intentions and principles in relation to its overall SHE performance which provides a framework for action and for the setting of SHE objectives

2.3 SHE Objectives

Overall SHE goal, arising from SHE policy, that an organization sets itself to achieve, and which is quantified wherever practicable

2.4 SHE Management Plan

Systematic plan specifying method, schedule, organization, person in Charge of achieving SHE Objectives

2.5 Management Review

Manager official review on the level, propriety of SHE procedure in accordance with SHE system, regulation, condition

2.6 Operation Management

SHE essencial management to apply for SHE policy, objectives, standard

2.7 SHE Management System Estimate

SHE reconsideration on the present condition of SHE composition requirement

2.8 Supervised Team Manager

Manager of Safety & Environment Team in charge of operating SHE system

2.9 Operation Team Manager

Team manager in charge of operating each team SHE plan

2.10 Incident

Getting out of normal situation or unexpected events causing loss within unacceptable limits

2.11 Accident

Unexpected events/things caused loss within unacceptable limits to human, Assets, products, raw material, environment

2.12 Hazard

Human disaster, Material loss, Environmental disaster, Occupational Disease, Potential danger element & situation

2.13 Risk

Mixing of occurrence potential and seriousness during accidents

2.14 Risk Assessment

Risk evaluation and decising process on the capacity of risk acceptability

2.15 Interested Parties

Individual or group concerned with or affected by the environmental performance or an organization

2.16 Environment

Air, Water, Soil, Natural Resources, Plants, Fauna, Human & operated surounding conditions including these interactions

2.17 Environmental Aspect

Organization's action, Products and service element to interact with Environment

2.18 Environmental Impact

Corporation activity, Products and Service's environmental change to have a good or bad effect on environment entirely or partially

2.19 Environmental Impact Evaluation

Evaluation by documents Element of an organization' s activities, products and services which can interact with the environment

2.20 SHE Performance

Measurable results of SHE management system, relating to an organizations control of the SHE aspects of its activities, products or services based on its SHE policy, objectives and targets

2. 21 Continual Improvement

Process of enhancing the environment management system to achieve improvements in overall environmental performance in line with the organization SHE Policy

2.22 Internal Audit

Systematic and documented verification process to objectively obtain and evaluate evidence to determine whether an organization SHE management conforms to SHE management audit criteria set by the organization, and communication of the results of this process to management

2.23 Prevention of Pollution

Use of processes, practices, materials or products that avoid, reduce of control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution

2.24 Non-Conformity

Accident, Pollution caused by all sorts of incident and accident or The things violating regulation & procedure

2.25 Emergency

Happened things without warning including incidents, accident, emergency

2.26 Emergency Situation

Things influenced or uninfluenced to environment, for example unnoticeable thing like as power failure, fire, explosion, car accident, war

1. Scope of Application

Pohang plant shall establish & carry out SHE policy to minimize the impact of risk And environmental impact. All persons working for or on behalf of the organization always shall develop steel pipe and perform production & service to minimize impact to influence SHE.

2. Responsibilities and Authorities

2.1 C.E.O (President)

1) Establishment and announcement of SHE policy

2) General handling on entire SHE management as CEO

2.2 Pohang Plant Manager

1) Overall management of SHE system as top management delegate

2.3 Manager of Safety & Environment Team

1) Establishment of SHE education plan and publicity activities

2) Establishment of definite objectives to attain SHE policy

2.4 Manager of Each Team

1) Teaching to team member about SHE policy

2) SHE policy reflection to team business

3. SHE POLICY

Seah Pohang plant publishes SHE Policy about managing SHE management as follow

3.1 Pohang plant shall follow the principle of SHE management and maintain all over the entire part. All persons working for or on behalf of the organization always shall develop steel pipe and perform production & service to minimize impact to influence SHE.

3.2 The organization top management delegate authority to plant manager the overall responsibility and authority of SHE management system.

3.3 All people who related with product design, production, transportation,sales and services be understood & come into action and set specific environmental objectives, targets to attain SHE policy. Organization members who work for organization or substitute for organization operate efficiently, carry out their duty and do their best to attain SHE objectives.

3.4 The organization shall announce SHE policy and can be read by interested parties to guarantee clearness and volition on SHE system.

3.5 The organization' top management appoints a specific management representative who establish, implement, maintain and manage continuously SHE system as manager of safety & environment team.

SHE Policy

Seah Pohang plant shall operate SHE policy to drive continual prevention activity for safe work condition and ecofriendly management as below.

1. To practice SHE activity as the first subject of management
2. To observe SHE law and related requirements
3. To strengthen SHE education for SHE operating capacity
4. Continual SHE improvement action
5. Prevention of environmental pollution & minimization of wastes
6. Minimization of energy use, Green House Gas emission
7. Set up & managing of safety & environment index

2012. 3. 5.

C.E.O (President)

1. Scope of Application

This chapter is applicable on all process that can occur in accordance with Process risk, harmful machine safety situation and health problem.

2. Responsibilities and Authorities

2.1 Plant Manager

1) Approval of Risk Assessment result

2.2 Manager of Safety & Environment Team

1) Set up, review, approval of risk assessment standard.
2) Risk assessment review
3) Set up and managing of Risk assessment procedure
4) Harmful machine review
5) MSDS Review, register and management

2.3 Manager of Each Team

1) Risk assessment on manufacture process
2) Risk assessment on raw material and storage
3) Risk assessment on production facilities maintenance
4) Risk assessment on new facility establishment & extention
5) Risk assessment on raw material transportation & carrying
6) Risk assessment on raw material transportation & carrying between factory
7) Risk assessment on outdoor order processing
8) Risk assessment on product storage & transportation
9) Risk assessment on resources storage
10) Risk assessment on resources deposit, carrying
11) Risk assessment on new product development
12) Risk assessment on safety accident
13) Risk assessment on relevant work
14) Relevant work law & regulation grasping

3. Procedure

3.1 Risk Assessment

1) Each team manager shall grasp all risks expected by normal, abnormal, emergency and past, present, future.
   (1) Harmful machine existence
   (2) Hazardous chemicals use
   (3) Protection equipment function for safety
   (4) Accident history
   (5) Accident frequency & strength
   (6) Indication & follow-up measure condition in checking facility
   (7) Risk in accordance to excess of work condition measurement
   (8) Risk in accordance to health diagnosis
   (9) Influence to region in accordance to accident
   (10) Risk in connection with work process
   (11) others
2) Risk assessment frequency is followed by Risk assessment manual (GR-8-1002-12)

3.2 Enrollment of Risk Assessment

1) Manager of Each team shall evaluate risk and request Safety & Environment Team to enroll.
2) Manager of Safety & Environment team shall review risk result of each team and approve, enroll, manage on primary risk.
3) The enrolled risk should be considered in establishing SHE objectives.

4. Related standard

1) Risk Assessment manual(GR-8-1002-12)

1. Scope of Application

The organization defines environmental aspects influenced directly & indirectly by design, manufacture, transportation & services in connection with products.

This chapter applies to responsibilities ,authorities and procedures that evaluate environmental impact.

2. Responsibilities and Authorities

2.1 Plant Manager

1) Approval of significant environmental impact register

2.2 Manager of Safety & Environment Team

1) Review & Approval of environmental impact evaluation standard
2) Gather & Review of environmental impact evaluation
3) Registration of significant environmental aspects
4) Supervision of environmental management committee to decide significant environmental aspects
5) Environmental impact evaluation on waste storage, transport &disposal
6) Environmental impact evaluation on building extension, rebuilding
7) Establishment & maintenance of evaluation procedure related to Environmental impacts
8) Enviromental regulation grasp on foundation, extension Environmental impact indirect evaluation on nearby factory

2.3 Manager of Production Team, Manager of Production Technology Team

1) Environmental impact evaluation on manufacture process
2) Environmental impact evaluation on raw,sub material storage&use
3) Environmental impact evaluation on maintain of production facilities

2.4 Manager of Facility Maintenance Team

1) Environmental impact evaluation on maintain of production & transport
2) Environmental impact evaluation on maintain of production sub facilities
3) Environmental impact evaluation on use of utility
4) Environmental impact evaluation on building extension, rebuilding

2.5 Manager of Logistics Team

1) Environmental impact evaluation on raw material transportation
2) Environmental impact evaluation on transportation of product & sub material inter-factory
3) Environmental impact evaluation on special article ordered & outside processed product transportation
4) Environmental impact evaluation in accordance to product storage & Transportation

2.6. Manager of Material Management Team (Pohang Part)

1) Environmental impact evaluation on material storage area
2) Environmental impact evaluation of transportation, storage and enter of material

2.7 Technical Research Institute

1) Environmental impact evaluation in accordance to development of new product
2) Environmental impact evaluation on foundation & extension project

2.8 Manager of Each Team

1) Environmental impact evaluation on relevant department work
2) Regulation & requirement grasp on relevant department

3. Procedure

3.1 Environmental Aspect grasping

1) Each team(department) grasp all expected environmental aspectson basis of environmental impact occurred on Normal, abnormal, emergency and the past, present and reflect to set up of environmental objectives, targets.
   (1) Impact on controlled and uncontrolled matter to emit in the air
   (2) Impact on controlled and uncontrolled matter to emit in the water
   (3) Impact on matter to emit in soil
   (4) Impact on waste discharge
   (5) Impact on energy and natural resources use
   (6) Impact on noise, dust, odor occurence

(7) Emission matter impact to influence on ecosystem

(8) Others (Impact occurred by support work and services)

2) Environmental aspects grasp and evaluation cycle is followed by environmental impact evaluation standard (GR-8 -1005- 06).

3.2 Environmental Impact Evaluation

1) Each department grasp environmental aspects and decide serious grade on according to evaluation standard and request enrollment of inventory.

2) Manager of Safety & Environment Team decide final grade on according to environmental management committee after review.

3) Manager of Safety & Environment Team register and manage serious environmental impact element separately and shall maintain serious environmental impact register in the latest version.

4. Record and Maintain

All record is followed by control of document regulation in connection with environmental aspect grasp and evaluation.

5. Related standard

1) Environmental impact evaluation standard (GR-8 -1005- 06)

1. Scope of Application

This chapter applies that organization grasp regulation directly or indirectly connected with on SHE aspects of organization action. Product and service and other requirements agreed by organization, responsibilities and authorities and work process.

2. Responsibilities and Authorities

2.1 Manager of Safety & Environment Team

1) Enroll and approval of SHE regulation and other requirement
2) Grasp and registration of SHE permission
3) Gather, translation and reply of SHE inside, outside information
4) Establish and maintain of procedure on SHE inside, outside information management
5) Register and approval of other legal requirement and requirement agreed by organization

2.2 Manager of business support Team

1) Identify and register of permission in connection with construction

2.3 Manager of Facility Maintenance Team

1) Identify and registration of permission on production sub facilities.

2.4 Manager of Each Team

1) Identify of legal and other requirement on related business

3. Procedure

3.1 Information gathering and translation

1) Each team manager grasps, gathers, receives legal and other requirement agreed by organization on related business.
2) Received data shall reflect business to translate related department.

3.2 Enrollment, Change and Reading

1) Manager of Safety & Environment Team shall enroll and maintain legal and other requirement agreed by organization in according to Safety health legal management standard (GR-8-1001-01), Environmental legal management standard (GR -8-1004-03).
2) Manager of Safety & Environment Team shall always maintain new version, display to be able to read.

4. Related standards

1) Safety environmental regulation (GR-8-1000-00
2) Safety health legal management manual (GR-8-1001-01)
3) Environmental legal management manual (GR -8-1004-03)
4) Communication management manual (GR-8-0103-00)

1. Scope of Application

It is applied to procedure of organization to minimize the influence on SHE and responsibilities, authorities and business process to establish SHE objects and targets to accomplish SHE policy.

2. Responsibilities and Authorities

2.1 Plant manager

1) Review and approval of SHE objectives and targets

2) Chairman of SHE management committee

2.2 Manager of Safety & Environment Team

1) Documentation of SHE objectives, targets and establish process

2) Hold SHE management committee and assistant administrator

2.3 Manager of Each Team

1) Establish and Review of SHE objectives as a member of SHE management committee

2) Establish and enforcement of team plan to accomplish acknowledged SHE objectives

3. Procedure

3.1 SHE objectives shall be established as follow.

1) Regulation and related requirement

2) Environmental policy and manager opinion

3) Technique and finances

4) Management requirement and opinion of interested party

3.2 SHE management committee review appropriately and validity of SHE objectives and targets, decide the order of priority and SHE objectives should be measuerable.

3.3 Manager of Safety Environment Team shall document and notice each team in accordance as Safety Health objective establish manual (GR-8-1001-02), Environmental objective establish manual(GR-8-1004-01) after plant manager approval about SHE objectives.

3.4 Manager of Safety & Environment Team identifies propel and achievement present situation of each team and reports when holding SHE management committee or reviewing SHE management.

4. Related standard

1) Safety Health objective establish manual (GR-8-1001-02)
2) Environmental objective establish manual(GR-8-1004-01)

1. Scope of Application

This chapter is applicable on organization responsibility and authority to operate effectively SHE management program as means to attain SHE objectives and targets on significant SHE element.

2. Responsibilities and Authorities

2.1 Plant manager

1) Approval of SHE management program propel plan

2.2 Manager of Safety & Environment Team

1) Management on all of SHE management program
2) Check of SHE management program progress

2.3 Manager of Each Team

1) Establish of SHE management program
2) Propel of SHE management program
3) Report of SHE management program result

3. Procedure

3.1 Manager of Each team establishes and implements SHE management program in according as Safety health objective establish manual (GR-8-1001-02), Environmental management program establish manual (GR-8-1004-02) to attain SHE objects including as below.

1) Organization function and person in charge designation to need attaing objectives each steps
2) Means of attaining objectives and specific propel schedule etc

3.2 Manager of Safety & Environment Team shall check regularly implement content of SHE management program.

3.3 Manager of Each team shall reimplement risk, environmental impact assessment, revise properly if organization action or new development, new product and service change.

3.4 Manager of Each team shall notice regularly to manager of Safety & Environment Team implement results in according to Safety health objective and Environmental management program.

3.5 Safety health objective and Environmental management program should be approved by plant manager.

4. Related standard

1) Safety health objective establish manual (GR-8-1001-02)

2) Environmental management program establish manual(GR-8-1004-01)

1. Scope of Application

This chapter is described on organization to manage SHE management system efficiently and applied on organization role, responsibility, authorities.

2. Responsibilities and Authorities

Organization for operating and managing SHE is like attachment 1, Responsibility and authority is as below.

2.1 C.E.O (President)

1) General handle on entire corporation management as CEO
2) Essencial resources provide for SHE system implement and management
3) Trust to factory manager overall responsibility and authorities on SHE management system & appoint Manager of Safety Environmental Team as manager representative
4) Establish and announcement of SHE policy

2.2 Plant manager

Overall management of SHE system as SHE responsibility

1) Overall management of SHE management system
2) Acknowledgement of SHE management program
3) Supply resources for achievement of SHE policy, objectives
4) Review & acknowledge of internal audit result
5) Acknowledgement of emergency training plan
6) Approval of Management review

2.3 Manager of Safety & Environment Team (Manager representative)

1) Establishment of SHE policy & objectives
2) Conduct of management review
3) Review, Report, Correction confirmation of internal audit result
4) Review of SHE manual & policy
5) Checking of SHE management program progress
6) Management of emergency training plan
7) Risk assessment & Acknowledgement

8) Registration and acknowledgement of SHE law & regulation
9) Work condition measurement & improvement plan
10) Harmful machine safety inspection
11) Establishment of SHE education plan
12) SHE result measure and assessment
13) Hazardous chemicals grasping and checking
14) Safeguard gear supply, manage and appropriateness confimation
15) Manage of Interested Parties
16) SHE policy notify to cooperated company
17) Confirmation of corrective & preventive action
18) Auditor education & grant qualification
19) Registration & management of significant environmental aspect
20) Assessment & management of waste disposal business
21) Environmental impact assessment according to waste storage, transportation & disposal
22) Handling & management of waste water disposal

2.4 Manager of Business Support Team

As a person in charge of team SHE work, The main responsible work is as below.

1) Risk assessment, Environmental impact assessment according to new structure, enlargement
2) Arrangement of appropriate human resources, work division & management of organization chart
3) Distinguish, establish, index & preservation of transfered SHE records
4) Environmental impact assessment on office supplies & equipment
5) Environmental impact assessment on company own vehicles

2.5 Manager of Production Team, Manager of Production Technology Team

As a person in charge of team SHE work, The main responsible work is as below.

1) Operate & Management of production process & production facilities
2) Use and handling method management of harmful chemicals

3) Risk assessment in advance and MSDS security when introducing hazardous Chemicals
4) Environmental impact assessment & risk assessment on production facilities & production process
5) Investigate of cause, correct and prevention action on nonconformities
6) Continuous improvement of working environment
7) Education, training on SHE
8) Risk & Environmental impact assessment on process improvement
9) Team(plant) SHE management program propel
10) Operation and management of pollutant emission facilities

2.6 Manager of Facility Maintenance Team

As a person in charge of team SHE work, The main responsible work is as below.

1) Risk & Environmental impact assessment on production assistant and facilities preservation management
2) Management of electric and relay facilities preservation
3) Design and installation of pollution control facilities.
4) Environmental impact assessment according to increase and decrease of energy use
5) Risk & Environmental impact assessment on operation of UTILITY facilities
6) Continuous improvement and review of production assistant facilities and transfer facilities
7) Establish and result management of annual energy use plan
8) Education, training on SHE relative
9) Team(plant) SHE management program propel
10) Efficial repair and management of emission prevention facilities

2.7 Manager of Logistics Team

As a person in charge of team SHE work, the main responsible work is as below.

1) Risk & Environmental impact assessment on raw material supply, demand & Management
2) Continuous improvement and review for process efficiency
3) Notice SHE policy to relative corporation when purchasing raw material
4) Risk & Environmental impact assessment of product load, shipping, Stack management
5) Risk & Environmental impact assessment of product transfer and delivery
6) Management of Transportation Company (subcontractors)

2.8 Technical Research Institute

1) Low pollution production development
2) Follow SHE policy when conducting project
3) Risk & environmental impact assessment when conducting project
4) Risk & Environmental impact assessment of related business
5) Team SHE management program propel

2.9 Manager of Quality Management Team

As a person in charge of team SHE work, the main responsible work is as below.

1) Eastablish of Internal audit plan
2) Management and correction of test calibration facilities
3) Education and training of Test and calibration member
4) Risk & Environmental impact assessment of related business
5) Team SHE management program propel

2.10 Manager of Material Management Team (Pohang Part)

1) Risk & Environmental impact assessment according to subsidiary material purchase, transportation, delivery
2) Notice SHE policy to related corporation when purchasing subsidiary material
3) Notice SHE policy in house subcontractor
4) Safety confirmation before purchase

2.11 Work Supervisor

As managing supervisor in charge of team operator(worker) safety, The main work is as below.

1) SHE system operating on the relevant work
2) Risk assessment
3) Education on safety and health
4) Managing and supervising on risk
5) Emergency Responce
6) Manage of safeguard gear
7) Necessary things for SHE maintenance

2.12 A site operator

The main work is as below for SHE maintenance.

1) Protection measure of facilities
2) Pollution protection and preventive action
3) Wearing safetyguard gear
4) Observance of Safety Environmental regulation

2.13 Honor Industry Safety Supervisor

The support and promotion of worker participation for SHE maintenance.

1) Self safety check, work condition examination
2) Improvement proposal for worker safety regulation

3. Delegate of Responsibility & Authority

3.1 Each team manager can trust granted task to lower position team member, but Responsibility on work is maintained continuously.

3.2 Each team manager shall grant responsibility and authority to team member who work in organization and all related people who work for Organization replace. And Guarantee working implementation without work stop to Trust appropriate qualified person when person in charge is vacant.

4. Safety Environmental Verification person

4.1 Manager of Each team shall arrange appropriate resources to grasp support matters and arrange trained person.

4.2 Verification include interaudit, facilities, calibration of measuring instrument, test analysis and measurement.

5. Related standard

1) Authority and responsibility regulation (SA - A - 210)

[Attachment #1]

1. Scope of Application

All employees who perform task to cause serious effects on safety health & environment are applied to training and qualification management responsibility, authority and procedures.

2. Responsibility and authority

2.1 Manager of safety & environment team

1) Designation of Legal SHE keeper and education training
2) Establish and accomplish education procedure for SHE inside and outside
3) Maintenance and management of records about education training

2.2 Manager of Each team

1) Identify whether need to training or not for team member
2) Granting the right for master of behavior of verification
3) The staff who is outsourcing for the company that performing on behalf of the association do training for SHE policy and so on

3. Procedure

3.1 Education and training for employee.

1) The company shall educate new employee, attendant verification activities, person who perform task to cause serious effects on SHE for a basic knowledge and skill.
2) Manager of each team who employs the staff who outsourcing company according to procedure same as team member' s ask for carry out training for SHE policy.

3.2 Training implementation for education

1) Managers of Safety environment team and each team have to plan according to Education Training plan mannal(GR-8-0303-01) defining education and training.
   (1) Importance of SHE system policy observance
   (2) Aspect of serious SHE effect in posse or real made by each activity and SHE profit is earned by individual improvement
   (3) Role and responsibility for observing SHE management requirement Including SHE policy and emergency preparedness & response

(4) The probable result when anyone break the rule

2) Managers of Safety environment team and each team educate recipient according to the standard of plan of education and training..

3) Manager of Each team shall educate SHE regulation to team member. If necessary, request Safety Environmental team necessary education.

4) Manager of Each team establishes supplement education plan

3.3 Qualification management

1) Manager of safety & environment team enrollment receiver who appointed by him.

2) Manager of Safety & Environment team should qualify for verifying employee eligibility criteria has been reached depending on Education Training plan manual(GR-8-0303-01) and based on training and experience.

4. Maintain of records

All records that related to education and qualification are maintained by according to Document management manual (GR-8-0401-01).

5. Related standards

1) Education Training plan manual (GR-8-0303-01)

2) Quality qualification manual (GR-6-0102-02)

1. Scope of Application

This is applicable to responsibilities and authority of organization and work process to receive deliver SHE information from parties having an interest of internal or external organization and effective communication with parties having an interest.

2. Responsibility and Authority

2.1 Plant manager

1) SHE information review and approval by internal / external parties having an interest

2)Internal delivery information and the latest information approval

2.2 Manager of Safety & environment team

1) Receive, review and record SHE information from internal / external parties having an interest

2) Delivery information to organization related to inner part

3) Receive information related to SHE and report on the results

4) Write and report on the latest information

5) Receive external information and distribute to relevant organization

2.3 Manager of Each team

1) Inform related managers when obtaining information related to SHE

2) Teaching and Training persons who perform jobs with information instead of team business or organization

3. Procedure

3.1 Manager of Safety & environment team receive SHE information from internal external parties having an interest, review and keep recording.

3.2 Manager of Safety & environment team obtain approval from plant manager with reviewing received SHE information.

4.3 After reviewing information, Manager of Safety & environment team should delivery any requirements to relevant team and if there needs cause analysis and measure relevant department should cooperate.

4.4 Manager of Safety & environment team notify the interested parties SHE policy and the latest information which is admitted to be possible for making public after obtaining approval from plant manager.

3.5 The information delivery system on emergency situation was delivered to all members of organization and the interested parties according to the system of emergency contacts.

3.6 Publicity activities were implemented to relevant members of organization and interested parties in order to improve SHE awareness.

4. Record maintenance

All records related to SHE information should be maintained according to Document management manual (GR-8-0401-01).

5. Related standard

1) Communication manual (GR-8-0103-00)

1. Scope of Application

As a means to ensure SHE policy, SHE objectives and targets by organization's activities, products and services, It applies to establish and maintain documented SHE management system.

2. Responsibility and Authority

2.1 C.E.O (President)

1) SHE policy formulation and approval
2) SHE policy publication

2.2 Plant manager

1) Continuous improvement and maintenance of SHE management system
2) Approval of SHE manual
3) Approval for technical standards

2.3 Manager of Safety & environment team

1) Review and evaluation the suitability and effectiveness of SHE management systems
2) Check compliance of SHE management system by audit
3) Enactment and amendment of SHEI management manual

2.4 Manager of Each team

1) For maintenance of SHE management systems, team member need job performance and education
2) Implementation of SHE management systems
3) Writing and reviewing of technical standards

3. Document structure of SHE management system

3.1 Document structure(Table 1)

Structure	LEVEL 1	LEVEL 2	LEVEL 3
Document	SHE Manual	1. Management standard 1) Regulation 2) standard 3) Norm - technical Norm - work norm	1.Internal Documents 1) Risk Assessment 2) Environmental impact assessment 3) Drawings, forms, contracts 2. External documents 1) SHE laws and Document 2) Customer Documents 3) domestic and foreign standards

3.2 Document structure is same with Table 1, if high document conflict with low document, high document is a priority.

1) SHE manual

It includes requirements about SHE management system

2) Regulations

This document prescribe responsibility, authority and work processing method to achieve work performance depending on the company's policy. It cannot be invalidated for requirements of SHE manual.

3) Standard

This document prescribes that characteristics of product and material meet quality and SHE requirements. It has products standard, materials standard, packing and display standard.

4) Technical norm

When specific work, business sequence, method, attention and used parts, facility, tool have some problems, this document prescribes how to handle the problems easily.

5) Work norm

This document prescribes responsibility, authority, and work handling methods to achieve work purpose according to SHE regulations and rules.

4. Enactment and application of SHE manual

4.1 SHE manual is documented SHE management system, it has basic SHE policy, accordance with the requirements of OHSAS(KOSHA) 18001, ISO 14001, each requirement has to specify coverage, responsibility, authority, work process, and connection with related documents.

4.2 SHE manual has to revise and reissue by each part, also table of contents and each pages had been write about revise number, revised date, pages, to check the newest edition or not.

4.3 Enactment, amendment, and approval of SHE management system documents followed by Standard management guide (GR-8-0204-00).

5. Distribution & management of SHE manual

5.1 Manager of Safety & environment team distributes SHE manual to CEO, executives, and all team leaders, if necessary, shall be submitted to the 3rd party certificate authority.

5.2 Duplicate cannot be open to the outside, without safety & environment team manager approval.

5.3 Manager of Safety & environment team has to collect and dispose before distribute revised document, and store invalided document that marked "REFERENCE.

5.4 Manager of Safety & environment team has to maintain the revision history of SHE manual.

6. Review of SHE manual

Relevance and efficiency of SHE manual has to be evaluated through internal evaluation and CEO's examination periodically.

7. Related standard

1) Standard management guide (GR-8-0204-00)

1. Scope of Application

It applies to Responsibility and Authority on management of SHE manual, technical standard, business standard & SHE document for keeping SHE management system.

2. Responsibility and Authority

2.1 Manager of Safety & environment team

1) Assurance of documentation concerning SHE management system
2) Publication, distribution, collect, discard of approved documents as supervise team manager of SHE manual, technical standard, business standard concerning SHE management
3) Document management of outside the company just like SHE law or information

2.2 Manager of Strategy plan team

Approval process, distribution, collect & disuse of SHE management regulation & standard

2.3 Manager of Quality management team

Approval process, distribution, collect & disuse of technical standard & business standard

2.4 Manager of Each team

Education & implement of all team member on SHE documents

3. Procedure

3.1 Review and approval of document draft

1) Manager of Each team must draw up documents for business performance according to standard management guide (GR-8-0204-00).
2) Drafting documents can be easily understood by user.
3) Document shall be reviewed, deliberated and approved by the person who is authorized according to company law management regulation.

4) Document shall be reviewed regularly, revised suitably as occasion demands And Revise procedure followed by standard management guide (GR-8-0204-00).
5) The changing items of revised document shall be distinguished by relevant document or attached document.

3.2 Distribution & collection of document

1) Manager of Safety & environment team shall identify distribute team requiring system function, distribute as approved document.
2) Document is always applicable to use by distributing valid document and Overpassed document is collected and discarded by distributed part.
3) If you store collected old document for law or preserving knowledge, you shall distinguish as "REFERENCE" for identifying invalid.
4) UNCONTROLED document can be distribute on reference by Manager of Safety & environment team, is not responsible for collecting and distributing on UNCONTROLED document.

3.3 Change of document

1) Changing document implement according to the same procedure as the first team draft if it is not special situation.
2) Revise contents must be attached for knowing changing state of document
3) Document revise process is followed by company regulations
4) Document change according to law change shall be approved and distributed after taking revise process

3.4 Document storage & maintain of management, register

1) Original document shall maintain, manage by supervised team.
2) SHE manual, regulation, standard, technical standard, business standard store on company regulation registry, other environmental document store according to Filing System.

3) Supervised team manager shall record, maintain for managing of document background.
4) Document management registry should be record as identifiable, revise number, approval date, revise background, distribute date.
5) All records shall be state clearly enact, revise date and store for regulated period.

4. Related standard

1) Standard management guide (GR-8-0204-00)

1. Scope of Application

It applies to Responsibility and Authority for organization operation and activities elements to need attaining SHE policy, objectives, targets related significant SHE aspects.

2. Responsibility and Authority

2.1 plant manager

1) Approval of SHE management system & result
2) Review of SHE management system & result
3) General management of SHE management system

2.2 Manager of Safety & environment team

1) Building & operating management of SHE management system
2) Review of SHE management program results
3) Set-up of SHE management standard concerning SHE law, regulation, other requirement
4) Grasp of emission and pollution control facilities

2.3. Manager of Each team

1) Propel of continual improvement action for attaining SHE policy, objectives
2) Establish and implement of environmental management program
3) Maintain of emission & pollution control

3. Procedure

3.1 Manager of Safety & environment team shall establish identified SHE management standard from law, regulation, other requirements and distribute to relevant team after plant manager approval.

3.2 Manager of Each team shall identify duty,activities and process that can have significant impact on the environment and have team members implement.

3.3 Manager of Related team shall communicate and establish related process for Contacter, supplier and service company making suitable supply, action.

3.4 Managers of Facility team and production team shall establish and maintain the implement process of regular check and repair.

3.5 Foundation, extension of process shall consult with Manager of Safety & environment team from plan step.

3.6 Manager of Relevant team shall educate operating guideand implement after Manager of Safety environment team approval if implement working that caused SHE impact by operate manager or subcontractor in organization.

3.7 Manager of Safety environment team estimates waste disposal corporation and dispose of in case of trust corporation and confirm trust process regularly.

3.8 Verify, measurement, test action of system operation management collaborate with each other and should be managed by prescribed result indicator that can guarantee efficiently.

4. Maintain of records

All records concerning operating management shall maintain according to Standard management guide(GR-8-0204-00).

5. Related standards

1) Purchase business regulation (GR-4-0200-00)
2) Safety environmental regulation (GR-8-1000-00)
3) Result measuring and monitoring mannal(GR-8-1002-14)
4) Monitoring and measuring mannual (GR-8-1005-07)

1. Scope of Application

It applies to Responsibility and Authority for preventing and reducing SHE aspects accompanied by accident and emergency.

2. Responsibility and Authority

2.1 Plant manager

1) Approval of accident & preparation for emergency training plan
2) Command & decide of emergency action

2.2 Manager of Safety & environment team

1) Training for accident & Emergency Preparedness & Response
2) General management of accident & Emergency
3) Grasp present condition, report, take action for emergency
4) Notify to interested party present situation

2.3 Manager of Each team

1) Site control and restoration implement according to emergency organization
2) Identify of potential SHE emergency and Establishment of measure standard that can minimize SHE impacts

3. Procedure

3.1 Manager of Safety & environment team shall document the process of establish, implement accident and emergency.

3.2 Manager of Safety & environment team shall revise appropriately by reviewing response procedure for minimizing and early restoring after emergency.

3.3 Manager of Each team shall establish cooperation system and take response action for minimizing SHE impacts.

3.4 Establish emergency action standard the facilities that judged concerned with emergency or appointed by Manager of Safety & environment team.

3.5 Establish emergency action standard the facilities that occurred in emergency or accident.

3.6 Each team should participate positively in accident and emergency training.

3.7 Emergency contact should be followed by emergency system in an emergency.

4. Maintain of records

All records concerning Emergency Preparedness & Response shall maintain according to Standard management guide(GR-8-0204-00)

5. Related standards

1) Safety emergency response manual (GR-8-1002-13)

2) Environmental response manual (GR-8-1005-08)

3) Communication manual (GR-8-0103-00)

1. Scope of Application

It is applied to the responsibilities and authorities of organization to monitor and measure action & main characteristics having a decisive effect on SHE.

2. Responsibility and Authority

2.1 Manager of Safety & environment team

1) Implement & result review of SHE objectives
2) Selection of monitoring and measuring site
3) Interpretation and action of monitoring and measuring data
4) Performance assessment of SHE law and regulation
5) Calibration and correction of monitoring and measuring facilities

2.2 Manager of Each team

1) Notify monitoring and relative team
2) Selection of Inspection & measuring person

3. procedure

3.1 Manager of Safety & environment team shall evaluate, record, maintain regularly SHE law and regulation compliance.

3.2 Manager of Safety & environment team shall establish and maintain procedure to pursuit suitability on result measurement and operation toward SHE objectives and targets.

3.3 Manager of Safety & environment team shall document region, monitoring site that influenced significantly on SHE and measuring team manager shall notice to Manager of Safety & environment team measuring records.

3.4 Manager of Safety & environment team shall interpret measuring record and take action appropriately.

3.5 Manager of Safety & environment team shall maintain the propriety and performance confirmation on harmful machine' s safety inspection.

3.6 Manager of Each team shall manage inspection and measuring instrument in accordance with inspection facility management manual(GR-6-0201-07) maintain measuring record.

3.7 Manager of Each team shall evaluate effectiveness of monitoring & measuring Records.

3.8 Manager of Each team shall review the previous monitoring and measuring record if unsuitable with correction standard, estimate effectiveness.

4. Maintain of records

All records concerning monitoring & measurement should be maintained by Standard management guide(GR-8-0204-00)

5. Related standards

1) Inspection facilities management manual (GR-6-0201-07)
2) Result measuring and monitoring manual(GR-8-1002-14)
3) Monitoring and measuring manual (GR-8-1005-07)

1. Scope of Application

It is applied to authority, procedure, responsibility of organization measures That relieve SHE effect caused by incongruity of SHE management system.

2. Responsibility and Authority

2.1 Plant manager

1) Approval of treatment way about Nonconformity

2.2 Manager of Safety & environment team

1) Review whether it's incongruity or not
2) Check content of incongruity treatment
3) eed back incongruity content and introducing review data of management

2.3 Manager of Each team

1) Analysing reason for nonconformity
2) Immediately corrective measure and countermeasure when incongruity is Found

3.procedure

3.1 Manager of Safety & environment team should notify related department of nonconformity report about implement of SHE management system when nonconformity situation occur as below.

(1) Complaint of interested parties
(2) Realistic, latent Incongruity about environment management system
(3) Commented issue as internal AUDIT
(4) As violated environment regulation and company standards
(5) Situation making serious SHE effect
(6) Nonconformity detected by safety patrol

3.2 Manager of Each team should notify safety environment team leader after figuring out reason, making corrective measures and preventive measures.

3.3 Manager of Safety & environment team reports as management review data after checking corrective measures and preventive measures for prevention of recurrence and handling contents.

3.4 Manager of Safety & environment team carries out and record and maintain all written procedural changes caused by preventive and corrective measure of nonconformity.

4. Maintain of records

All records related to incongruity, corrective measure, preventive measure are maintained by Standard management guide(GR-8-0204-00).

5. Related standards

1) Safety environmental regulation(GR-8-1000-00)

2) Nonconformity, Correction , Preventive action manual(GR-8-1002-15)

1. Scope of Application

It is applied to authority, procedure, responsibility related to disposition, maintain, reading, identification of SHE records in order to prove requirement performance of SHE management system.

2. Responsibility and Authority

2.1 Manager of Safety & environment team

1) Reading SHE record to persons concerned
2) Reading transferred SHE record
3) Making preservation term of SHE record

2.2 Manager of each team

1) Understanding, distinguishing, filing, maintaining, discarding SHE records

3. procedure

3.1 SHE record is made by related standard to let person understand easily and revision date should be recorded.

3.2 SHE record should be approved by decision man and stored to each department.

3.3 SHE record is controlled, stored in offprint style, computer disk. It should be filed by Standard management guide(GR-8-0204-00) to be distinguished, searched.

3.4 SHE record should be stored, maintained in proper storage facilities that can prevent damage,loss.

3.5 Preservation term of environment record required by law should be extended more than period of legal requirement. other environment records should be preserved by specified period in each team document list or Standard management guide(GR-8-0204-00).

3.6 Related record that is necessary for confidentiality in SHE record should be understood, maintained.

3.7 The kind of environment record is separately decided at Standard management guide(GR-8-0204-00).

4. Related standard

1) Standard management guide(GR-8-0204-00)

1. Scope of Application

It is applied to responsibility ,authority, procedure on internal Audit for verify to perform documentary process and SHE management implement.

2. Responsibilities and Authorities

2.1 Plant manager

1) Approval of audit plan

2.2 Manager of safety & environment team

1) Establish of audit plan
2) Verify of audit result corrective action
3) General report of audit result
4) audit enforcement
5) qualification of auditor

2.3 Auditor

1) audit and nonconformity report draw-up

2.4 Manager of Inspected team

1) Audit attendance, reply and suggest evidence
2) Corrective action of nonconformity report

3. Process

3.1 Audit plan

1) Manager of safety & environment team carry out internal audit over two times a year for suitability evaluation & effectiveness verification.
2) Manager of safety & environment team establish annual plan to need audit purpose, audit scope, audit schedule, auditor selection and distribute inspected team after plant manager approval.
3) Auditor must be granted qualification and appointed in irregardness of inspected team.

3.2 Audit implement

1) Audit is implemented on base of documented CHECK LIST, related action SHE importance, past audit result.
2) Auditor shall investigate objective evidence for effective performance.
3) Auditor shall submit Safety Environmental team manager nonconformities after confirmed by inspected team manager.

3.3 Report of audit results

1) Manager of safety & environment team request corrective action plan concerning nonconformities.
2) Manager of safety & environment team shall report to plant manager after drafting audit result report.

3.4 Management of nonconformities

1) Manager of Inspected team submit to Manager of safety & environment team corrective action plan concerning nonconformities.
2) Manager of safety & environment team confirm continuously whether corrective action plan implement.
3) Manager of safety & environment team shall report to plant manager through nonconformities report or management reviewand maintain for definite period.

4. Record & maintain

All records related with internal audit shall maintain according to Standard management guide(GR-8-0204-00).

5. Related standard

1) Safety internal audit mannual (GR-8-1002-16)
2) Environmental internal audit mannual (GR-8-1005-09)

1. Scope of Application

This measure applies to organizational responsibilities, authorities and procedures for SHE management system's review and evaluation.

2. Responsibilities and Authorities

2.1 C.E.O (President)

1) Final approval of management review

2.2 Plant manager

1) Review of SHE activity
2) SHE policy's review related with SHE policy change

2.3 Manager of safety & environment team

1) Collection of SHE management review data, analysis and document
2) Policy proposal of internal/external SHE management

3. Procedure

3.1 Plant manager must perform review of environment management at least once a year, which guarantees consecutive efficiency and adaptness of SHE management system.

3.2 Manager of safety & environment shall submit items including next at least once a year.

1) SHE policy, objective achievement
2) Progress of SHE management program & result
3) SHE legal regulatory requirements, observance evaluation results about organizational requirements
4) Authorized institution's requirements & internal audit
5) SHE internal & external information and public environmental problem
6) Non-confirmance item prevention & corrective action

7) Surrounding condition ofinternal external change, proposal for improvement
8) Following action for former management review
9) Communication with external interested party
10) Meeting result of industrial safety health committee
11) SHE information on new invest and supplement of facilities

3.3 Management review procedures shall be reviewed by SHE management committe or manager of saftey & environmental which should reviews SHE management system. The results shall be reported to top manager.

3.4 Non-conformances of Management Review should be renovated by related manager. Manager of saftey & environment team should report the result to top manager.

4. Related standard

1) Safety health management review manual (GR-8-1002-17)
2) Environmental management review manual (GR-8-1005-11)
3) Environmental management committee manual (GR-8-1005-10)

PREQUALIFICATION STATEMENTS

CARBON STEEL PIPE

SëAH Steel

SěAH

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I. COMPANY PROFILE

- Brief Histroy
- Address
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FOREWORD

If I look back last 50 year history of SeAH Steel, the company sowed the seeds for steel industry in the barren land in Korea and has left clear mark on steel industry history by exporting steel Pipes to the USA for the first time in Korea among other achievements.
This was attained by challenging spirit of SeAH to lead the change of the era and indomitable courage to face the crisis. Above all, I believe that the seed of SeAH was able to grow based on love and encouragement of our customers and shareholders.
Presently, SeAH Steel has Pohang Factory and Changwon Factory having the largest manufacturing capacity of pipes in Korea. In addition, our company has been able to produce and supply the best quality of steel plates through continuous investment into cutting-edge manufacturing facilities and via efforts of quality innovation since 1998.

Now, SeAH Steel with the solid foundation of accumulated reputation and trust, will surely become a blue-chip company by continuous effort toward change and innovation based on eco-friendly operation and administration with integrity to not disappoint our valued customers, shareholders and the society.

Steel makes the world beautiful not only at the visible places but also at the invisible places. Steel is like a good friend who is always at our side.

Please keep in mind SeAH is always at the center of your life. Thank you.

□□□ □rd □□□
PRESIDENT & CEO

SěAH

BREIF HISTORY

Oct.	1960	:	Pusan Steel Pipe Corporation established in Busan
Mar.	1965	:	Obtained "KS" Monogram
Aug.	1967	:	Steel pipes exported to the United States for the first time in Korea
May.	1969	:	Company shares listed on the Korea Stock Exchange
Aug.	1970	:	Seoul Plant went into operation
Oct.	1973	:	Spiral welded pipe mill started operation in Seoul Plant
Out.	1979	:	The first Pohang plant went into operation
Mar.	1979	:	Authorized to use "API" monogram on casing & tubing, on high tensile line pipe and on line pipe
Aug.	1980	:	The second Pohang plant went into operation
Apr.	1981	:	Obtained "LR'(Lloyd's Register shipping Monogram) and "DNV"(Det Norske Veritas) for welded steel pipe
Dec.	1981	:	Awarded One hundred million U.S. dollar Export Tower
Jun.	1982	:	Pohang plant has been authorized as the "A" grade factory under the quality control program
Oct.	1982	:	Obtained "UL" label for rigid steel conduit approved by Underwriters Laboratories
Jan.	1983	:	The third Pohang plant went into operation covering upto 20 inch high grade line pipe and OCTG.
Jun.	1983	:	Obtained "JIS" monogram
Jan.	1985	:	Production of pre-insulated pipe initiated under the technical tie-up with Ecopipe, AB, Sweden
Mar.	1990	:	Stainless steel pipe mill went into operation in Seoul plant
Jun.	1991	:	Large diameter manufacturing mill(OD. 22"~80") went into operation
Jan.	1993	:	Obtain ISO 9001 Certificate
July.	1995	:	Authorized to use "API" monogram on "2B"
Jan.	1996	:	Changed Company name to SeAH Steel Corporation
Aug.	1997	:	Obtained ISO 14001 Certificate for Environmental System
June.	1998	:	Established Pro-Coated metal Plant in Gunsan
Aug.	1999	:	Became the first korean company to develop Duplex stainless pipe.
Oct.	2000	:	Moved head-officce to Jung-gu Bongnae-Dong
Jan.	2001	:	The Ansan plant went into operation
July.	2001	:	Split-off (SeAH Steel Corporation, SeAH Holdings Corporation)
Sep.	2005	:	Established Galvanized Steel Sheets Plant in Gunsan
Nov.	2005	:	Awarded two hundred million U.S. dollar Export Tower
Feb.	2007	:	SeAH-POSCO announced a strategic alliance by swapping equities
Nov.	2008	:	Awarded three hundred million U.S. dollar Export Tower
Nov.	2009	:	Awarded four hundred million U.S. dollar Export Tower
Apr.	2010	:	Established SeAH Steel U.A.E. LLC Plant in Ras Al-Khaima
Apr.	2011	:	Established Middle east office
Jan.	2013	:	Established Suncheon Plant

ADDRESS

SeAH Steel Corporation
Homepage Address: www.seahsteel.co.kr

HEAD OFFICE
Address : SeAH Tower, 45 Yanghwa-ro, Mapo-gu, Seoul 121-841, Korea
CPO Box : 2293, Seoul
Telephone : 82-2-6970-1000
Facsimile : 82-2-6970-1199

POHANG PLANT (CARBON STEEL PIPE)
Address : 14-1, Jangheung-Dong, Nam-Gu, Pohang, Gyeungbuk, Korea
Telephone : 82-54-271-4114
Facsimile : 82-54-285-6401

POHANG MUNDEOK PLANT(CARBON STEEL PIPE)
Address : Songdeok-ro 228-11, Ocheon-eup, Nam-Gu, Pohang-City, Gyeongbuk, Korea
Telephone : 82-54-286-0916
Facsimile : 82-54-286-0912

GUNSAN PIPE PLANT (CARBON STEEL PIPE)
Address : 876, Osikdo-Dong, Gunsan, Jeonbuk, Korea
Telephone : 82-63-460-7500
Facsimile : 82-63-460-7520

GUNSAN FLAT PRODUCT PLANT(GALVANIZED STEEL SHEETS / PRE-COATED METAL)
Address : 1632-19, Sroyong-Dong, Gunsan, Jeonbuk, Korea
Telephone : 82-63-469-8500
Facsimile : 82-63469-8521

CHANGWON PLANT (STAINLESS STEEL PIPE)
Address : 50, Ungnam-Dong, Changwon, Gyeungnam, Korea
Telephone : 82-55-278-2222
Facsimile : 82-55-289-8848

SUNCHEON PLANT(CARBON & STAINLESS STEEL PIPE)
Address : Block 3, Yulchon 1st Industrial Complex, Sinseong-ri, Haeryong-myeon, Suncheon, Jeonnam, Korea
Telephone : 82-61-760-2500
Facsimile : 82-61-760-2697

BUSAN OFFICE
Address : 729-1, Hakjang-Gond, Sasang-Gu, Busan, Korea
Telephone : 82-51-311-4521
Facsimile : 82-51-311-4530

GWANGJU OFFICE
Address : 913-10, Dongrim-Dong, Buk-Gu, Gwangju, Korea
Telephone : 82-62-515-0890
Facsimile : 82-62-515-0898

DAEGU OFFICE
Address : 179-4, Sangyeok-Dong, Buk-Gu, Daegu, Korea
Telephone : 82-53-383-0510
Facsimile : 82-53-383-0501

BEIJING OFFICE
Address : Room 521, Towercrest Plaza No.3 Maizidian West Road, Chaoyang District, Beijing, Chaina, 100016
Telephone : 86-10-8458-3298
Facsimile : 86-10-8458-5885

MIDDLE EAST OFFICE
Address : Jebel Ali Free Zone LOB 180703 P.O. BOX263476 Dubai, U.A.E.
Telephone : 971-4-884-1624
Facsimile : 971-4-884-1625

SěAH

BOARD OF DIRECTORS

Name	Position
Sun-Hyung Lee	Chairman
Howard Lee	President & CEO
Jae-Woo Ha	Senior Executive President & CEO
Yeanjai Lee	Senior Executive President
Yongseog Kim	Outside director
Changjin Cho	Outside director
Giwon Kang	Auditor
Chongseung Choi	Auditor

CAPITAL

TOTAL LIABILITIES	:	USD 695 Million
TOTAL EQUITY	:	USD 946 Million
TOTAL ASSET	:	USD 1,641 Million
GROSS PROFIT	:	USD 190 Million

PLANT SITES

HEAD OFFICE	:	258㎡
POHANG PLANT	:	474,763 ㎡
CHANGWON PLANT	:	90,167 ㎡
GUNSAN PLANT	:	132,606 ㎡
GUNSAN No.2 PLANT	:	76,000 ㎡
SUNCHEON PLANT	:	269,306 ㎡
BUSAN OFFICE	:	7,045 ㎡
GWANGJU OFFICE	:	3,965 ㎡

PERSONNEL STATUS

DIRECTORS	:	17
ADMINISTRATORS & ENGINEERS	:	313
TECHNICIANS	:	510
OTHERS	:	79
TOTAL	:	919

SeAH

ORGANIZATION

2013. Jan. 01

BANK REFERENCES

SHINHAN BANK

Address	:	14,1ga, Namdaemun-ro, Jung-Gu, Seoul, Korea
Cable	:	CHOHKRSE
Telephone	:	82-2-2010-2114

HANA BANK (K.C.C.I)

Address	:	45, Yanghwa-ro, Mapo-Gu, Seoul, 121-841, Korea
Cable	:	HNBNKRSE
Telephone	:	82-2-6970-3037

THE AFFILIATED COMPANIES

SeAH Steel America, Inc. (SSA)

Relationship	:	Overseas Corporation Located in the U.S.A Hold 89% of Shares
Business	:	Import, Distribute and Wholesale of Pipes and Tubes (USD 703 Million)/Year
Address	:	9615 S.Norwalk Blvd., Suite B, Santa Fe Springs, CA 90670, U.S.A
Telephone	:	1-562-692-0600
Facsimile	:	1-562-692-9295
Office	:	Houston branch

Address - 14550 torrey Chase Blvd., Suite 310 Houston, Texas 77014, U.S.A

Telephone - 1-281-873-7137

Facsimile - 1-281-876-9517

PanMeridian

Address - 14550 torrey Chase Blvd., Suite 345 Houston, Texas 77014, U.S.A

Telephone - 1-281-873-7800

Facsimile - 1-281-873-7873

STATE PIPE & SUPPLY, Inc.

Relationship	:	Overseas Corporation Located in the U.S.A Hold 40% of Shares
Product	:	Carbon Steel Pipe
Address	:	9615 S. Norwarlk Blvd., Santa Fe Springs, CA 90670, U.S.A
Telephone	:	1-562-695-5555
Facsimile	:	1-562-692-1054

BREIF HISTORY

SeAH JAPAN CO., Ltd.

Relationship	:	Hold 100% of Shares
Business	:	Import, Distribute and Wholesale of Pipes and Tubes
Address	:	5F.6-1,2-Chome, Nishi-Shinbashi,Minato-ku, Tokyo 105-0003, Japan
Telephone	:	81-3-3501-1347
Facsimile	:	81-3-3501-1387

VIETNAM STEEL PIPE CO., Ltd.

Relationship	:	Hold 50% of Shares
Product	:	Carbon Steel Pipe
Address	:	Km 9, Vat Cach, Hong Bang District1 Haiphong City, Vietnam
Telephone	:	84-318-50116
Facsimile	:	84-318-50114

SeAH STEEL VINA CORP.

Relationship	:	Hold 100% of Shares
Product	:	Carbon Steel Pipe
Address	:	No. 7 Street 3A, Bien Hoa Industrial zone, Dong Nai Vietnam
Telephone	:	84-61-833733
Facsimile	:	84-61-833734

LANDMARK STEEL CORP.

Relationship	:	Hold 50% of Shares
Product	:	Steel Structure, Panel
Address	:	Shangdian Village(North), Zhangjiawan Town Tongzhou District Beijing, China,101113
Telephone	:	010-6150-3154
Facsimile	:	010-6156-7077

United Spiral Pipe, LLC.

Relationship	:	Hold 30% of Shares
Product	:	Carbon Steel Pipe
Address	:	900 Loveridge Road, Pittsburg. CA 94565, USA
Telephone	:	1-925-439-3060
Facsimile	:	1-925-439-3064

SeAH STEEL U.A.E., LLC.

Relationship	:	Hold 100% of Shares
Product	:	Carbon Steel Pipe
Address	:	Al Ghail Industrial Zone of RAKIA, Ras Al Khaimah, U.A.E.

Ⅱ. □ SE MAN□ A□

• Please refer to HSE Manual

Ⅲ. STATEMENT O□ S□ PP□□ E□ PERIENCE

- Sales Record
- Statement of Supply Experience on Tender Base

SALES RECORD

UNIT
- Quantity : Thousand M/T
- Amount : Domestic / 1 Mill, won
  Export / USD 1,000

YEAR	EXPORT		DOMESTIC		TOTAL QUANTITY
	QUANTITY	AMOUNT	QUANTITY	AMOUNT	
1988	238	138,000	192	83,300	430
1989	204	120,000	261	111,800	465
1990	205	116,000	299	144,000	504
1991	198	115,000	320	173,100	518
1992	189	101,000	339	201,300	528
1993	212	111,000	347	193,700	559
1994	201	99,000	385	222,300	586
1995	209	127,815	461	310,667	670
1996	238	106,700	530	357,000	788
1997	250	113,000	600	372,000	850
1998	310	200,000	340	347,000	650
1999	318	177,129	457	308,613	775
2000	349	156,906	506	361,190	855
2001	364	165,416	587	408,711	951
2002	361	177,643	601	439,191	962
2003	355	181,384	740	511,972	1,095
2004	276	200,182	721	646,632	997
2005	288	278,968	688	673,302	976
2006	311	259,302	551	474,652	862
2007	321	282,567	581	540,427	902
2008	400	585,815	532	781,124	932
2009	208	249,106	417	443,496	625
2010	493	327,347	373	612,379	866
2011	437	591,504	455	627,656	892
2012	552	692,277	490	637,953	1,042

SěAH

STATEMENT OF SUPPLY EXPERIENCE ON TENDER BASE

ASIA

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. API 5L GR.X52 (18")	7,080	1983.01.	SUI GAS TRANSMISSION CO. LTD. PAKISTAN
2. TUBULAR PILE JIS G 3444 STK 500 (12")	3,000	1983.03.	PUBLIC WORKS DEPT GOVERNMENT OF BRUNEI
3. API 5LGR.X56 (2",3½",4",6",8")	363	1984.01.	BAKHRABAD GAS SYSTEMS LTD. BANGLADESH
API 5L GR.B (10", 12")	945		
4. API 5L GR.X52 (2", 6", 8")	2,341	1984.02.	BAKHRABAD GAS SYSTEMS LTD. BANGLADESH
API 5L GR.B (4", 6", 10")	1,797		
API 5L GR.A (12",14")	40		
5. API 5L GR.X46 (16")	4,906	1984.06.	PAKISTAN PETROLEUM LTD. PAKISTAN
6. API 5L GR.X52 (12")	2,619	1984.06.	ATTOCK CEMENT PAKISTAN
7. API 5L GR.X56 (20")	7,873	1984.08.	BAKHRABAD GAS SYSTEM STD. BANGLADESH
8. ASTM A53 GR.A (8")	571	1986.10.	BECO BANGLADESH
9. SKK 490 (24")	4,003	1986.11.	MINMETAL CHINA
10. STPG 410 (10")	3,400	1986.12.	MINMETAL CHINA
11. API 5L GR.X52 (10")	1,934	1987.05.	KESC PAKISTAN
12. API 5L GR.X52 (18")	3,767	1987.06.	SGTC PAKISTAN
13. API 5L GR.X52 (10")	3,607	1987.06.	MINMETAL CHINA
14. API 5L GR.X52 (20")	3,000	1988.06.	ONGC INDIA

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
15. API 5L GR.X52 (20")	2,230	1988.11.	ONGC INDIA
16. API 5L GR.X56 (20")	1,466	1988.11.	ONGC INDIA
17. STPG 410 (7",10",12")	4,488	1989.07.	MINMETAL CHINA
18. ASTM A53 GR.B (14")	3,571	1989.07.	ONGC INDIA
19. API 5L GR.X52 (20")	1,849	1989.08.	T1TAS GAS BANGLADESH
20. ASTM A500 GR.B (6", 8")	365	1989.11.	NTPC INDIA
21. API 5L GR.B (10",18",20")	2,602	1989.11.	NTPC INDIA
22. API 5L GR.X42/GR.B	5,060	1990.01.	SNGPL PAKISTAN
23. API 5L GR.B	1,380	1990.03.	
24. API 5CT GR.J55	1,435	1990.06.	SNGPL PAKISTAN
25. API 5CT GR.J55	3,000	1992.02.	MINMETAL CHINA
26. API 5L GR.X42	4,000	1992.06.	PERTAMINA INDONESIA
27. API 5L GR.X60	15,000	1992.11.	SSGCK PAKISTAN
28. API 5L GR.X52	6,000	1993.03.	SNGPK PAKISTAN
29. API 5L GR.X52	8,000	1993.07.	GAIL INDIA
30. API 5L GR.X42 API 5CT GR.J55	3,500	1994.03.	MOGE MYANMAR
31. API 5L GR.X42	2,000	1994.06.	GMSB MALAYSIA
32. API 5CT GR.J55	3,000	1995.04.	MOGE MYANMAR
33. API 5L GR.X42	10,000	1995.10.	MOGE MYANMAR

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
34. API 5L GR.X52	2,000	1996.01.	TITAS & JALALABAD BANGLADESH
35. API 5L GR.X56	1,500	1996.08.	BGSL BANGLADESH
36. API 5L GR.X52 (14")	5,000	1996.10.	CNOOC CHINA (BOHAI) (OFFSHORE)
37. API 5L GR.X52 (12", 14")	36,000	1997.11.	CNOOC CHINA (PINGHU) (OFFSHORE)
38. API 5L GR.X42 API 5CT GR.J55	27,000	1997.03.	MOGE MYANMAR
39. API 5L GR.X52 (24")	3,000	1998.01.	APEX TAIWAN
40. API 5L GR.X52/X60 (26"X0.500", 8"~18")	19,000	1999.02.	COOBC CHINA (OFFSHORE)
41. API 5L GR.X60/X65 (12",16")	26,000	1999.03.	GAIL INDIA
42. API 5L GR.X65 (18"X6.4/9.5/7.9/12.7MM)	15,000	1999.05.	PETRONET INDIA
43. JIS A5525 SKK490 (24"X9/14MM)	4,800	1999.05.	TEPCO JAPAN
44. API 5L GR.X42 (10"X0.365", 14"X0.375")	38,000	1999.09.	MOGE MYANMAR
45. ASTM SA178 GR.A,C (1 ½ , 1 ¼")	1,800	1999.10.	ABB INDONESIA
46. API 5L GR.X52 (6"~16")	8,500	1999.10.	CPC TAIWAN
47. API 5L GR.X46 (12")	1,300	2000.04.	NIRMA INDIA
48. API 5L GR.X60 (16")	1,500	2000.06.	ECCO-ASIA
49. API 5L GR.X42/X46 (20")	24,000	2000.06.	MOGE MYANMAR

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
50. API 5L X52/X60 (16",20")	1,530	2000.08.	CNOOC CHINA
51. API 5L GR.X46 (14")	6,300	2000.08.	HPCL INDIA
52. API 5L GR.X52 (12")	1,970	2000.10.	GAIL INDIA
53. API 5L GR.B (2"~20")	10,000	2000.11.	CALTEX INDONESIA
54. API 5L GR.X52/GR.B (8", 6", 24")	3,700	2001.04.	NIOC IRAN
55. API 5L GR.X52 (20"X0.438") API 5CT GR.K55 (20"X0.438")	200 400	2001.08.	ONGC INDIA
56. API 5L GR.X52 (16"X0.375",16"X0.500")	1,700	2001.08.	BRITISH PETROLUEM INDONESIA
57. API 5L GR.X65 (10"X8.7,11.1)	7,000	2001.11.	NIOC IRAN
58. API 5L GR.X60 (14"X6.4/7.1MM)	20,000	2001.12.	BPCL INDIA
59. API 5L GR.X60	2,200	2001.12.	PETRONAS MALAYSIA
60. SKK490/SKK400 (24"X14MM)	8,000	2002.01.	TAISEI CONSTRUCTION JAPAN
61. API 5LGR.X65 (22"X12.7MM)	18,000	2002.03.	CNOOC CHINA (OFFSHORE)
62. API 5CT GR.J55 (4", 9⅝, 13⅜")	5,000	2002.01.	OCCIDENTAL OF OMAN
63. API 5L GR.X52 (4"X4.8/5.9/7.1MM)	1,300	2002.01.	NOIC IRAN
64. API 5L GR.X42 (18"X7.1/7.9MM)	2,800	2002.02.	GAIL INDIA
65. API 5CT GR.K55 (20"X11.1MM) API 5L GR.X56 (20"X11.1MM)	1,000	2002.03.	ONGC INDIA (OFFSHORE)

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
66. API 5L GR.X60 (12"X5.6MM, 20"X6.4/7.1MM)	11,000	2002.07.	CNOOC CHINA
67. API 5L GR.X65/GR.B (42",30"X0.812") API 5L GR.X52 (10", 12",20")	1,900	2002.06.	NIGC IRAN
68. API 5L GR.B (8"~24")	3,600	2002.07.	RELIANCE INDIA
69. API 5L GR.X52 (20"X11.1MM)	1,100	2002.08.	ONGC INDIA
70. API 5L GR.X65 (28"X12.7MM)	19,000	2002.07.	PGN INDONESIA (OFFSHORE)
71. API 5L GR.X52 (20"X11.1MM)	1,100	2002.08.	ONGC INDIA
72. SKK490 (900MMX10MM)	16,400	2002.09.	SAKAI LNG JAPAN
73. API 5L GR.X52 (4"~10")	5,100	2002.11.	GULF INDONESIA RESOURCES
74. ASME SA 178 GR.A,D (38.1 MM)	1,925	2002.02.	BOBCOCK-HITAHCHI JAPAN
75. API 5L GR.X65 (8"~16")	15,000	2003.02~04.	L&.T INDIA
76. API 5L GR.X65 (16"X12.7/14.3MM)	2,300	2003.04.	COOEC CHINA (OFFSHORE)
77. API 5L X65/PSL2 (16"X6.4~11.1MM)	4,700	2003.07.	MECON INDIA
78. API 5L GR.X60 (28",30")	28,000	2003.06.	HYUNDAI HEAVY INDUSTRY CHINA (OFFSHORE)
79. API 5L GR.X60 (12"~16")	5,500	2003.09.	CNOOC CHINA (OFFSHORE)

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
80. API 5L GR.X60 (14", 16")	10,000	2003.10.	ESSAR CONSTRUCTION LTD. INDIA
81. API 5CTGR.J55 (10¾"X0.350", 13⅜"X0.380")	10,000	2003.10.	WUXI SEAMLESS CHINA
82. API 5L GR.B	154	2004.01.	MHI JAPAN
83. API 5L GR.X52/X56 (18"X9.5MM, 12"X12.7MM)	8,000	2004.02.	CNOOC CHINA (OFFSHORE)
84. API 5L GR.B (12"X9.5MM)	2,600	2004.10.	PTT(MAKKASAN) THAILAND
85. API 5L GR.X65 (18"X9.5/10.3MM, 12" X9.5MM)	5,000	2005.01.	CNOOC CHINA (GUANGDONG LNG) (OFFSHORE)
86. API 5L GR.B	667	2005.05.	MHI JAPAN
87. ASME SA178 GR.A (38.1 MMX2.5MMX21M)	2,834	2005.08.	MHI JAPAN
88. API 5L GR.X65 (18"X15.9MM)	11,000	2005.08.	KNOC VIETNAM (OFFSHORE)
89. ASTM A178 (38.1 MM)	2,800	2005.09.	MHI JAPAN
90. API 5L GR.B (1"~102")	1,594	2006.01.	MHI JAPAN
91. API 5L GR.B (16"X9.5MM)	1,200	2006.04.	TECHNIP VIETNAM
92. API 5L GR.B (1"~52")	1,949	2006.07.	MHI JAPAN
93. JIS STB 340 (60.3MM)	718	2007.01.	MIURA CO., LTD JAPAN
94. ASME SA214 (21.4/31.75MM)	1,240	2007.04~06	KNM PROCESS SYSTEM MALAYSIA
95. API 5L GR.B (2"~52")	515	2007.05.	MHI JAPAN

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
96. API 5L GR.B/ASTM A671 (2"~52")	1,317	2007.10.	MHI JAPAN
97. API 5L GR.X70 (20"X17.5/14.3/12.7MM)	46,385	2008.01	ESSAR CONSTRUCTION INDIA
98. API 5L GR.B (2"~60")	1,149	2008.03.	MHI JAPAN
99. API 5L GR.B (14"~48"X9.5MM~25.4MM)	2,936	2008.04	PNOC PHILIPPINES
100. API 5L GR.X65 (12"X10.2/11.2/12.2MM)	10,600	2008.05	CNOOC CHINA (OFFSHORE)
101. API 5L GR.B (2"~72")	800	2008.06.	MHI JAPAN
102. API 5L GR.X65 (12"X14.3MM)	3,410	2008.09	CNOOC CHINA (OFFSHORE)
103. ASME SA178 GR.A, C, D (38.1MMX4.7MM)	1,500	2008.10.	BABCOCK HITACHI JAPAN
104. ASME SA178	566	2009.02	K&L TUBULAR CORP. JAPAN
105. API 5L GR.X46 (20"X14.3MM)	4,100	2009.07.	MOGE MYANMAR
106. API 5L GR.X65 (10"X12.7MM)	8,000	2009.08.	PTSC VIETNAM
107. API 5L GR.X52 (10"X12.7MM)	670	2009.09.	PETRONAS MALAYSIA
108. API 5L GR.X65 (14"X11.1/12.7MM)	8,600	2010.10.	CNOOC CHINA (OFFSHORE)
109. ASME SA178 GR.A,C,D (38.1MM X 2.6~2.7T)	696	2010.XX.	BABCOCK HITACHI JAPAN
110. JIS STB340 (60.3MM X 3.2T)	590	2010.XX.	MIURA CO.,LTD JAPAN

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
111. ASME SA178 GR.A,C (31.75~63.5MM X 2.67 ~3.81T)	1,996	2010.XX.	NOOTER ERIKSEN MALAYSIA
112. ASME SA178 GR.A,C,D (38.1MM X 2.6~2.7T)	474	2011.XX.	BABCOCK HITACHI JAPAN
113. ASME SA178 GR.A,C (31.75~63.5MM X 2.67 ~3.81T)	1,070	2011.XX.	NOOTER ERIKSEN MALAYSIA
114. ASME SA214 (25.4MM X 2.11~2.77T)	1,240	2011.02.~05.	KNM PROCESS SYSTEM SDN. BHD. SINGAPORE
115. JIS STB340 (60.3MM X 3.2T)	567	2012.XX.	MIURA CO.,LTD JAPAN
116. ASME SA214 (25.4MM X 2.11T)	1,240	2012.03.~06.	KNM PROCESS SYSTEM SDN. BHD. SINGAPORE
117. API 5L GR.B (24"X9.5MM)	1,030	2012.05.	VOPAK & DIALOG MALAYSIA
118. API 5L GR.X65 (16"X12.7T)	750	2012.08.	CHEVRON BANGLADESH
119. API 5L GR.B (20", 24"X9.5MM)	4,640	2012.11.	VOPAK & DIALOG MALAYSIA
120. API 5L GR.B (4", 6")	4,185	2013.03.	VICO INDONESIA INDONESIA

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SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. ASTM A252 GR.2 (24"X10MM)	1,500	1999.01.	ARBED ETHIOPIA
2. API 5L GR.X52 (12"X9.9/12.7MM)	1,700	2001.04.	NVGC EGYPT
3. API 5L GR.X52 (12"X0.375")	3,166	2001.08.	WEPCO EGYPT
4. API 5L GR.X65 (8"~16")	17,000	2003.01.	SONEAS PIPE LINE TANZANIA
5. API 5L GR.X56 (20"X9.5MM)	13,000	2003.05~06.	GNPOC SUDAN
API 5L GR.B (6",10")	2,000		
6. API 5L GR.X42 (24"X9.5MM, 6"X7.1MM)	4,642/190	2005.12.	WNPOC SUDAN
7. ASTM A53 GR.B (24"X8.85/16.60MM)	4,500	2008.02.	DYNATEC MADAGASCAR &AMBATOVY MINERALS
8. API 5L GR.X65 (16"X17.5MM)	4,700	2011.09.	ABU QIR PETROLEUM EGYPT

E□ ROPE

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. ASTM A53 GR.B (6")	5,000	1989.05.	PROMSYRIO IMPORT USSR
2. API 5L GR.X52 (24")	625	2000.07.	CHEVRON U.K
3. ASTM A672 C65 CL22 (30"~54")	1,010	2007.02~04.	TECNIMONT ITALY
4. API 5L GR.X65 (40",42"X14MM)	10,000	2010.08.	TRANSNEFT RUSSIA

MI□□□E EAST

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. TUBULAR STEEL POLES	13,310	1982.09.	MINISTRY OF INDUSTRY & MINERAL STATE ORGANIZATION OF ELECTRICITYIRAQ IRAQ
2. BS1387/67 MEDIUM (½"~2")	2,578	1986.01.	ISOI IRAQ
3. API 5L GR.B	12,000	1990.03.	NIGC IRAN
4. API 5L GR.B	3,270	1990.12.	NATIONAL IRANIAN GAS CORP. NIGC IRAN
5. API 5L GR.X60	8,955	1990.07~12.	ARAMCO SAUDI ARABIA
6. API 5L GR.X52	2,714	1990.07~12.	SAUDI ARABIA
7. API 5L GR.X60/X52	6,694	1991.10.	SAUDI ARABIA
8. API 5L GR.X60	11,500	1991.10.	ARAMCO SAUDI ARABIA
9. API 5L GR.X60/X52 (8"/12")	2,000	1995.12.	ARAMCO SAUDI ARABIA (SOUR SERVICE)
10. API 5L GR.X52 (24" ,28")	1,700	1996.03.	NIOC IRAN
11. API 5L GR.X60 (6"X0.250")	2,000	1996.06.	ARAMCO SAUDI ARABIA
12. API 5L GR.X52	3,200	1996.06.	KOC KUWAIT
13. API 5L GR.B (6"XSCH80)	7,000	1997.01.	KOC KUWAIT
14. API 5L GR.X60 (4"X0.321"/0.375"/0.500")	10,000	1998.10.	PERTOKEMYA SAUDI ARABIA
15. API 5L GR.X52 (30"X0.625")	600	1998.11.	NIOC IRAN
16. API 5L GR.X52 (24"X0.375",32"X0.406",36"X0.375")	2,000	1998.08.	ADCO U.A.E
17. API 5L GR.X42/X52 (8",12")	6,000	2000.05.	OIEC IRAN
18. API 5L GR.B/X42/X65 (12", 36", 42")	4,300	2000.09.	NIGC IRAN
19. API 5L GR.B/X52/X60 (26 ",32", 16",20",22")	1,500	2000.11.	NIOC IRAN
20. API 5L GR.X52 (42",36",32")	590	2001.04.	ADWEA/TRANSCO U.A.E
21. API 5L GR.X60 (26"X9.5MM~12.7MM, 30"X9.5MM~12.7MM)	14,000	2001.05~12.	NIOC IRAN

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
22. API 5L GR.X60 (24"X6.4M M,7.1 M M)	12,000	2001.06~08.	ARAMCO SAUDI ARABIA
23. ASTM A214 (1"X2.11MM)	338	2004.03.	DAMAFIN BOILER IRAN
24. API 5L GR.X60 (24"X11.1MM)	5,700	2004.05.	NIGC IRAN
25. API 5L GR.X60 (12"X14.3/10.3MM)	3,500	2004.10.	NIOC IRAN
26. API 5L GR.X52 (20"X12.7MM)	780	2005.10.	SIEMENS RAS RAFFAN IRAN
27. API 5L GR.X60 (20"X6.35MM)	2,600	2005.10.	NIGC IRAN
28. API 5L GR.X60 (24"X11.1MM)	1,300	2005.10.	NIGC IRAN
29. API 5L GR.B (10"~48"XSTD)	1,400	2005.10.	IOEC IRAN
30. API 5L GR.X52 (14"X0.281")	950	2005.12.	NIOEC IRAN
31. API 5L GR.X60/X42 (12"X0.312")	2,155/250	2006.02.	SGC SYRIA
32. API 5L GR.X42(6"~24") API 5L GR.B(4"~6")	17,630 370	2006.02.	SCOP IRAQ (SOUR SERVICE)
33. API 5L GR.X42 (20"X0.312")	3,200	2006.03.	NIGC IRAN
34. API 5L GR.X60 (20"X0.375"/0.312")	900	2006. 03	NIGC IRAN
35. API 5L GR.X42 (8"X5.2~6.4MM)	900	2006. 03.	NIGC IRAN
36. ASTM A214 (1"X2.11MM)	260	2006. 03.	DAMAFIN BOILER IRAN
37. ASTM A53 GR.B (3"~24")	1,750	2006. 12.	KURVERS SAUDI ARABIA
38. API 5L GR.B (2"~30"XSTD)	1,000	2007. 01.	KGOC KUWAIT
39. ASTM A214 (1 "X2.11MM)	90	2007. 03.	DAMAFIN BOILER IRAN
40. IS03183 L245 (10", 18")	1,115	2007. 04.	PDO OMAN
41. API 5L GR.B (4",12"XSTD)	3,186	2007. 04.	KGOC KUWAIT

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
42. API 5L GR.B (2"~16"XSTD)	2,375	2007. 08.	KGOC KUWAIT
43. API 5L GR.X60 (36"X9.5/12.7MM)	1,240	2007. 10.	IOPTC IRAN
44. API 5L GR.B (4",6"XSTD)	8,206	2008. 01.	KGOC KUWAIT
45. API 5L GR.B (30"~48"X9.5/12.7MM)	4,500	2008. 05.	ARAMCO SAUDI ARABIA
46. API 5L GR.B (4",6"XSTD)	4,045	2008. 09.	KGOC KUWAIT
47. API 5L GR.B (4",6"XSTD)	4,045	2009. 01.	KGOC KUWAIT
48. API 5L GR.X60 (16"X8.7MM)	2,730	2009. 05.	SGC SYRIA (SOUR SERVICE)
49. API 5L GR.X60/X65 (20",24")	18,753	2009. 06.	NIGC(IGEDC) IRAN
50. ISO3183 L415 (16",18")	220	2009. 07.	PDO OMAN (SOUR SERVICE)
51. ASME SA214 (25.4~38.1MMX2.11T)	1,259	2010. 01.~03.	KNM PROCESS SYSTEM SDN. BHD. U.A.E
52. ASME SA214 (25.4~38.1MMX2.11~2.77T)	851	2011. 06.	KNM PROCESS SYSTEM SDN. BHD. U.A.E
53. ASME SA214 (25.4~38.1MMX2.11~2.77T)	1,116	2012. 04.~05.	KNM PROCESS SYSTEM SDN. BHD. U.A.E
54. ASTM A53 GR.B (2"~24"X3.91MM~17.48MM)	7,400	2012. 05.	SADARA PJT(DOW-ARAMCO) SAUDI ARABIA
55. ASTM A671 C70 CL12 (30"~32"X9.53MM~19.05MM) API 5L GR.B	1,650	2012. 06.	SADARA PJT(DOW-ARAMCO) SAUDI ARABIA
56. API 5L GR.B (6"~20"X7.1MM~12.7MM)	6,500	2012. 09.	SADARA PJT(DOW-ARAMCO) SAUDI ARABIA
57. API 5L GR.B/X60 (10"~16"X9.5MM)	6,060	2012. 12.	IRAQ SCOP

NORTH AMERICA

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. ASME SA178 GR.A, C (1½",1¼")	1,000	1999.05.	ABB U.S.A
2. ASTM A252 GR.3 (24")	6,000	2000.07.	CHICAGO BRIDGE & IRON COMPANY U.S.A
3. API 5L GR.X60 (20"X0.562")	11,000	2001.08.	JONAH U.S.A
4. ASME SA178 GR.A (2"X2½")	544	2002.01.	MC KENNA BOILER WORKS U.S.A
5. ASME SA178 GR.A, C, D (1½"X2")	5,425	2002.02.	DELTAK TUBULARS LTD. U.S.A
6. API 5L GR.X52 (24"X0.375")	10,700	2002.05.	NW NATURAL GAS CO. U.S.A
7. ASTM A252 GR.3 (24"X12.7MM)	7,050	2002.11.	ATRANTIC LNG COMPANY U.S.A
8. API 5L GR.X52 (24"X9.5MM)	11,500	2003.08.	NORTHWEST NATURAL GAS U.S.A
9. ASME SA178 GR.A (1½"X2")	1,652	2004.01.	DELTAK TUBULARS LTD. U.S.A
10. ASTM A672 C70 CL22 (24"~30")	2,225	2004.11.	CAL ENERGY U.S.A
11. ASME SA178 GR.A (1.315"~2")	263	2005.01.	MC KENNA BOILER WORKS U.S.A
12. ASTM A672 C70 CL22 (16"~24")	1,535	2005.11.	CAL ENERGY U.S.A
13. API 5L GR.X42 (3"X0.300", 4"X0.318")	1,520	2007.04.	MC TUBULAR U.S.A
14. API 5L GR.X80 ($17^{15}/_{16}$"X0.500")	280	2007.05.	GRANT PRIDECO U.S.A
15. API 5L GR.X56 (20",24"X0.625")	6,475	2007.11.	FRANKS CASING U.S.A
16. API 5L GR.X65 (20"X0.438")	1,300	2008.01.	DOW CHEMICAL U.S.A

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
17. ASME SA178 GR.A, C (1.25"~1.75"X0.105"~0.150")	2,200	2010.09.	NOOTER/ERIKSEN U.S.A
18. API 5L GR.X52/X60 (20" X 0.344"~0.500")	27,000	2011.12.	SEAH STEEL AMERICA, Inc. U.S.A, U.S.A(EAGLE FORD PJT)
19. API 5L GR.X52/X65 (8,5/8"~20")	22,000	2012.02.	SHELL U.S.A
20. API 5L GR.X52 (16" X 0.375")	16,000	2012.05.	SEAH STEEL AMERICA, Inc. U.S.A (MISSISSIPPIAN PJT)
21. API 5L GR.X52 (10"~12")	3,000	2012.06.	CHEVRON U.S.A
22. API 5L GR.X52/X60 (20"X0.344"~0.500")	7,000	2012.08.	SEAH STEEL AMERICA, Inc. U.S.A (LYSSY PROJECT)
23. API 5L GR.X52 (4,1/2"~12,3/4"XSTD)	20,000	2012.10.	SEAH STEEL AMERICA, Inc. U.S.A (SPRABERRY PROJECT)

□ATIN AMERICA

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. API 5L GR.X60 (24"X0.228"/0.375"/0.406")	30,000	1997.11.	PEMEX MEXICO
2. API 5L GR.X65	2,600	2001.09.	PSI PERU
3. API 5L GR.X65 (20"X8.7MM~12.7MM)	4,700	2003.08.	ENAP CHILE
4. API 5L GR.X65 (8"X6.35MM~9.53MM)	3,800	2003.08.	COLLAHUASI CHILE
5. API 5L GR.X60 (24"X6.4MM)	10,000	2004.08.	MINERA ESCONDIDA CHILE
6. API 5L GR.B (24"X9.5MM)	4,400	2006.04.	SANKO SIDER BRAZIL
7. API 5L GR.B/X42 (16"~22"X7.1MM~10.3MM)	2,604	2007.11.	WILSON CHILE
8. API 5L GR.X42 (10"X9.5MM,12.7MM)	5,240	2008.09.	SONACOL CHILE
9. ASTM A672 GR.60 (30"~60"X9.53/12.70/15.88MM)	1,200	2009.02.	PEMEX MEXICO
10. API 5L GR.B (8"~12"X9.5/12.7MM)	4,040	2009.12.	SAVIA PERU S.A. PERU
11. API 5L GR.B (3,1/2"~60"X12.7MM~63.5MM)	10,654	2010.02.	SAVIA PERU S.A. PERU

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
12. API 5L GR.B/X42 (3,1/2"~42'X9.5MM~57.2MM)	4,311	2010.07.	SAVIA PERU S.A. PERU
13. API 5L GR.B /X52/2B 2W50 (12'"~70"X12.7MM~63.5MM)	4,057	2010.08.	SAVIA PERU S.A. PERU
14. API 5L X42/X52/2B/2H50 (3, ½"~70"X6.4~63.5MM)	4,400	2011.08.	SAVIA PERU S.A. PERU
15. API 5L GR.B (6"~42")	3,260	2012.05.	PDVSA VENEZUELA
16. API 5L GR.B (14"X6.4/7.1MM)	464	2012.08.	CONDEMON DOMINICAN REP.
17. API 2B 2H50/A36 (14"~72"X9.5MM~63.5MM)	8,900	2012.09.	CICSA MEXICO

OCEANIA

SPEC /SIZE	Q'TY(MT)	AWARDED DATE	AUTHORITY
1. API 5L GR.B (6", 8")	825	1982.08.	THE STATE
2. API 5L GR.X52 (6", 12")	1,137	1983.01.	SANTOS AUSTRALIA
3. API 5L GR.X65 (20")	4,686	1983.03.	SANTOS AUSTRALIA
4. API 5L GR.X60	17,500	1991.01.	KUTUBU PETROLEUM DEVELOPMENT PROJ. VILLIAMS BROTHERS CMPS ENGINEERING & CHEVRON U.S.A PAPUA NEW GUINEA
5. API 5L GR.X70	13,000	1995.02.	GOLD FIELD GAS TRANSMISSION PTY LTD. AUSTRALIA
6. API 5L GR.X65 (24")	4,100	2000.02.	EPIC ENERGY AUSTRALIA
7. API 5L GR.X70 (14"X7.8MM)	23,000	2002.09.	SEA GAS AUSTRALIA
8. API 5L GR.X56 (4"X4.0MM)	700	2003.01.	SANTOS AUSTRALIA
9. API 5L GR.X42 (20"X12.7MM)	4,800	2005.12.	AGILITY AUSTRALIA
10. API 5L GR.X52 (8"X7.9MM)	1,139	2006.01.	OIL SEARCH AUSTRALIA
11. API 5L GR.X70 (10"X11.1/12.7MM)	4,250	2007.04.	OK TEDI PAPUA NEW GUINEA
12. API 5LGR.X70 (20"X10.2~12.2MM)	11,074	2008.07.	ORIGIN ENERGY AUSTRALIA
13. API 5L GR. X70 (10"X11.1/12.7MM)	3,100	2011.08.	OK TEDI PAPUA NEW GUINEA
14. AS1163 C350L0 (14",18"X9.5/12.7MMX18~22MM)	2,940	2012.05.	AP LNG AUSTRALIA
15. API 5L GR.X52/X65 (4"~12"X4~9.5MM)	8,200	2012.09.	SANTOS AUSTRALIA

Ⅳ. P□ANT □ESCRIPTIONS

- Size Range
- Pipe Making Equipment
- Product List

SIZE RANGE

PRODUCT		SIZE RANGE			CAPACITY (Ton/Year)	LOCATION
		O.D.	THICKNESS(mm)	LENGTH(m)		
ERW	ROUND	1" ~ 24"	1.6 ~ 22.0	4.5 ~ 21.0	930,000	POHANG
	SQUARE	200X200 ~ 400X400	4.5 ~ 14.0	5.0 ~ 20.0		
	ROUND	1/2" ~ 8"	1.2 ~ 11.0	4.0 ~ 15.8	240,000	KUNSAN
	SQUARE	20X25 ~ 150X150 30X20 ~ 200X100	1.2 ~ 9.0	4.0 ~ 15.5		
	SRM	1/2" ~ 4"	2.2 ~ 15.2	4.5 ~ 12.8	85,000	POHANG
SAW	JCOE	16" ~ 64"	Max. 65	Max. 18.288	575,000	POHANG
	ROLL BENDING	20" ~ 56"	Max. 25.4	Max. 12.2		POHANG
		40" ~ 197"	Max. 128	Max. 4.2		SUNCHEON
	SPIRAL	16" ~ 158"	Max. 25.4	Max. 70		SUNCHEON
GALVANIZING		1/2" ~ 24"	-	Max. 8.0	120,000	KUNSAN
ERW (OCTG)	CNC THREADING	4 1/2" ~ 20"	-	18	180,000	POHANG
	Q/T	4 1/2" ~ 9 5/8"	-	18	60,000	POHANG

◆ ERW SIZE RANGE

◆ SRM SIZE RANGE

◆ SAW SIZE RANGE

◆ QT SIZE RANGE

◆ CNC SIZE RANGE

PIPE MAKING EQUIPMENT

1. POHANG PLANT

ITEM NO.	DESCRIPTION	Q'TY	CAPA. / YEAR (M/T)	MAKER	LOCATION
1. SLITTER					
1-1	Pulling Type	1 Line		Abbey Etna	Pohang
1-2	Pulling Type	1 Line		Wean united	Pohang
2. TUBE MILL					
2-1	HF ERW 2½"	1 Line	50,000	Abbey Etna	Pohang
2-2	HF ERW 2½ "	1 Line	50,000	Pusan Pipe	Pohang
2-3	HF ERW 2½ "	1 Line	70,000	Mannesmann	Pohang
2-4	HF ERW 6"	1 Line	120,000	Pusan Pipe	Pohang
2-5	HF ERW 8"	1 Line	180,000	Pusan Pipe	Pohang
2-6	HF ERW 20"	1 Line	240,000	Pusan Pipe	Pohang
2-7	HF SAW(spiral)	2 Line	95,000	Pusan Pipe	Pohang
2-8	HF SAW(straight)	1 Line	75,000	Haeusler	Pohang
2-9	HF ERW 24"	1 Line	320,000	Pusan Pipe	Pohang
2-10	HF SAW(JCOE)	1 Line	200,000	SMS MEER	Pohang
	Total	12 Line	1,400,000	Kocks	Pohang
3. ROLLING MILL					
3-1	Stretch Reducing Mill	1 Line	50,000	Aeg-Elotherm	Pohang
4. WELD SEAM POST ANNEALER					
4-1	Continuous, local heating of the liner weldseam 3 units high frequency type	5 sets			
5. ELECTRIC INDUCTION HEATER		1 set	120,000	Kocks	Pohang
6. NONOXIDING CONTINUOUS HEAT TREATMENT FURNACE		1 Line	25,000	Kanto Yakin	Pohang

ITEM NO.	DESCRIPTION	Q'TY	CAPA. / YEAR (M/T)	MAKER	LOCATION
7. STRAIGHTENING M/C					
7-1	Hydraulic type	1 set		Kocks	Pohang
7-2	Hydraulic type	1 set		DMS(France)	Pohang
7-3	Hydraulic type VRM 75	1 set		Kieserling	Pohang
7-4	Hydraulic type VRM 115	1 set		Kieserling	Pohang
7-5	Hydraulic or manual type	1 set		Bronx	Pohang
7-6	Hydraulic type	1 set		Kikaico	Pohang
7-7	Hydraulic type	1 set		Kyoritsu	Pohang
7-8	Hydraulic type VRM 225	1 set		Kieserling	Pohang
7-9	Hydraulic type (6-Roll)	2 sets		Wounjin(Korea)	Pohang
8. FACING M / C					
8-1	Automatic mill type	4 sets		Kieserling	Pohang
8-2	Automatic mill type	2 sets		PMC	Pohang
8-3	Automatic mill type	1 set		IKEKAI	Pohang
8-4	Automatic mill type	3 sets		Mannesmann	Pohang
8-5	Automatic mill type	3 sets		Pusan Pipe	Pohang
8-6	Semi Automatic type	1 set		Pusan Pipe	Pohang
9. THREADING M / C					
9-1	Automatic mill type	1 set		PMC	Pohang
9-2	Automatic mill type	3 sets		Landis	Pohang
9-3	Automatic mill type	1 set		IKEKAI	Pohang
9-4	Semi Automatic mill type	1 set		Albrecht	Pohang
9-5	Automatic mill type	1 set		Mannesmann	Pohang
9-6	Automatic mill type	1 set		Kieserling	Pohang
9-7	C.N.C - Lathe(OCTG 13 3/8")	1 set		Taiyo Seiki Mori Seiki	Pohang
9-8	C.N.C - Lathe(OCTG 20")	2 sets		Okuma	Pohang
10. HEAT TREATMENT FURNACE		2furnace (12set burner/each farnace)		Shinsung Tech. (Korea)	Pohang

2. SUNCHEON PLANT

2-1. SUNCHEON PLANT(PRESS)

ITEM NO.	DESCRIPTION	Q'TY	CAPA.	MAKER	LOCATION
1. FORMING					
1-1	Pre-Bending M/C	1 Line	L:13.2M X O.D:1575MM X T:64MM	Win Win(Korea)	SUNCHEON
1-2	Press Bending M/C	1 Line	7,000 TON	Win Win(Korea)	SUNCHEON
1-3	Post-Bending M/C	1 Line	L:13.2M X O.D:1575MM X T:40MM	Win Win(Korea)	SUNCHEON
1-4	Calibration Press	1 Line	3,500 TON	Sogang(Korea)	SUNCHEON
2. WELDING					
2-1	Tack Welding M/C	1 Line	L:13.2M X O.D:1575MM X T:64MM	Win Win(Korea)	SUNCHEON
2-2	SAW Inside Welding M/C	2 Line	DC(1500A) AC1, AC2(1200A)	JongHap M/C(Korea) (Welding source : Lincoln)	SUNCHEON
2-3	SAW Outside Welding M/C	3 Line	DC(1500A) AC1, AC2, AC3 (1200A)	JongHap M/C(Korea) (Welding source : Lincoln)	SUNCHEON
2-4	Repair Welding M/C (FCAW)	1 Line	DC600A	DaeWooWelding NationalSystem	SUNCHEON
2-5	Repair Welding M/C (SMAW)	3 Line	AC200A	DaeWooWelding	SUNCHEON
2-6	Gouging M/C	2 Line	DC1000A	DaeWooWelding	SUNCHEON
3. CUTTING					
3-1	Flame Cutting M/C	1 Line	L:15M X W:5.5M X T:150MM	Koike Korea	SUNCHEON
3-2	Edge Grinding M/C	1 Line	L:13.2M X W:5.0M X T:64MM	Win Win(Korea)	SUNCHEON
3-3	Edge Milling M/C	1 Line	L:13.2M X W:5.0M X T:64MM	S&T(Korea)	SUNCHEON
3-4	Longitudinal Seam Milling M/C	1 Line	GROOVE TYPE : U	S&T(Korea)	SUNCHEON
3-5	End Beveling M/C	1 Line	I, V, TULIP TYPE	S&T(Korea)	SUNCHEON
4. HEAT TREATMENT					
4-1	Heat Treatment furnace	1 Line	130TON/CHARGE TEMP.: MAX.1050℃	Dongsung (Korea)	SUNCHEON

2-2. SUNCHEON PLANT(ROLL BENDER)

ITEM NO.	DESCRIPTION	Q'TY	CAPA.	MAKER	LOCATION
1. FORMING					
1-1	Roll-Bending M/C	1 Line	O.D: 40"~ 197" W.T: UP TO 128MM LENGTH:UP TO 4.2M	DAVI	SUNCHEON
2. WELDING					
2-1	SAW Inside Welding M/C	2 Line	DC(1500A) AC1, AC2(1200A)	JongHap M/C(Korea) (Welding source: Lincoln)	SUNCHEON
2-2	SAW Outside Welding M/C	2 Line	DC(1500A) AC1, AC2,AC3 (1200A)	JongHap M/C(Korea) (Welding source: Lincoln)	SUNCHEON
2-3	Circle Seam Inside Welding M/C	1 Line	DC(1500A) AC(1200A)	JongHap M/C(Korea) (Welding source: Lincoln)	SUNCHEON
2-4	Circle Seam Outside Welding M/C	1 Line	DC(1500A) AC1,AC2(1200A)	JongHap M/C(Korea) (Welding source: Lincoln)	SUNCHEON
3. CUTTING					
3-1	Flame Cutting M/C	1 Line	L:15M X W:5.5M X T:150MM	Koike Korea	SUNCHEON
3-2	Pipe End Cutting M/C	1 Line	MAX. 80MM	JongHap M/C (Korea)	SUNCHEON
3-3	CNC Profile Cutting M/C	1 Line	5AXIS CNC	S&T(Korea)	SUNCHEON
3-4	Longitudinal Seam Milling M/C	1 Line	GROOVE TYPE:U	Win Win(Korea)	SUNCHEON
3-5	Circle Seam Milling M/C	1 Line	GROOVE TYPE:U	Win Win(Korea)	SUNCHEON
4. FIT-UP					
4-1	Pipe Fit-up M/C	1 Line	100TON (ø1,000~ ø5,000) (UP TO 36M)	SPP Machine Tech.	SUNCHEON

2-3. SUNCHEON PLANT(SPIRAL)

ITEM NO.	DESCRIPTION	Q'TY	CAPA.	MAKER	LOCATION
1. IN LET ZONE					
1-1	Un-coiler & Coil feeder M/C	2 Line	MAX. 30TON	JAEWON(Korea)	SUNCHEON
1-2	Flatter M/C	2 Line	3-ROLLER	JAEWON(Korea)	SUNCHEON
1-3	Side Guide M/C	2 Line	525MM/MIN	JAEWON(Korea)	SUNCHEON
1-4	Cross Welder M/C	2 Line	2 POLE	JAEWON(Korea)	SUNCHEON
1-5	Leveler M/C	2 Line	AC2.2KW X 1/43 SCREW JACK X 4SETS	JAEWON(Korea)	SUNCHEON
1-6	Edge Miller M/C & Chip	2 Line	300MM/MIN	JAEWON(Korea)	SUNCHEON
1-7	Conveyor System Main drive M/C	2 Line	0.5~4.0M/MIN	JAEWON(Korea)	SUNCHEON
1-8	Edge Pre-bending M/C	2 Line	MAX. 200TON	JAEWON(Korea)	SUNCHEON
2. FORMING STATION ZONE					
2-1	Forning side guide roll	2 Line	EXPANDING SIZE: 3200/3600MM	JAEWON(Korea)	SUNCHEON
2-2	Inner beam M/C	4 Line	SELECTING RANGE ø400~600 ø700~3,000 ø400~650 ø700~4,000	JAEWON(Korea)	SUNCHEON SUNCHEON SUNCHEON SUNCHEON SUNCHEON SUNCHEON
2-3					
2-4	Bottom roller M/C	2 Line	ROLLER ANGLE 10 ~ 48°	JAEWON(Korea)	SUNCHEON
2-5	Outside Forming roller M/C	2 Line	400~3000MM 1SET 400~4000MM 1SET	JAEWON(Korea)	
2-6	Outside Welding M/C	2 Line	2 POLE	JAEWON(Korea)	SUNCHEON
2-7	Flux Recovery System	2 Line	300KGS	JAEWON(Korea)	SUNCHEON
2-8	Push-Pull Rod	2 Line	PUSH FORCE 180~250TON 2SET	JAEWON(Korea)	SUNCHEON
3. RUN OUT TABLE ZONE					
3-1	V-Gate Roller M/C	2 Line	3 ROLLER	JAEWON(Korea)	SUNCHEON
3-2	Cut-Off Carriage M/C	2 Line	PLASMA CUTTER 200A	JAEWON(Korea)	SUNCHEON
3-3	Out-Let table & Gap Control System	2 Line	80TON LIFTER	JAEWON(Korea)	SUNCHEON
4. WELDING EQUIPMENT					
4-1	In-side Welding M/C	2 Line	SAW DC2000A,AC1200A 3 POLE	Lincoln Welder M/C	
4-2	Out-side Welding M/C	2 Line	SAW DC2000A,AC1200A 2 POLE	Lincoln Welder M/C	
4-3	Cross Welding M/C	2 Line	SAW DC2000A,AC1200A 2 POLE	Lincoln Welder M/C	

3. KUNSAN PIPE PLANT

ITEM NO.	DESCRIPTION	Q'TY	CAPA.	MAKER	LOCATION
1. SLITTER					
1-1	Slitting M/C	1 Line	25	SeAH	KUNSAN
1-2	Slitting M/C	1 Line	30	MYEONG-JIN	KUNSAN
2. Tube Mill ERW					
2-1	ERW 1 1/2"	1 Line	20,000	SeAH	KUNSAN
2-2	ERW 4"	1 Line	40,000	PSP TOYOELECTMF G.CO	KUNSAN
2-3	ERW 2"	1 Line	50,000	SeAH	KUNSAN
2-4	ERW 8"	1 Line	90,000	SeAH	KUNSAN
3. Straightening M/C					
3-1	O.D 19.1 ~ 76.3 mm	1 Line	-	WONJIN	KUNSAN
3-2	O.D 34.0 ~ 114.3 mm	1 Line	-	SeAH	KUNSAN
3-3	O.D 34.0 ~ 60.5 mm	1 Line	-	KIESERLING	KUNSAN
3-4	O.D 114.3 ~ 216.3 mm	1 Line	-	MYEONG-JIN	KUNSAN
4. Facing M/C					
4-1	O.D 19.1 ~ 76.3 mm	1 Line	-	DONGWOO	KUNSAN
4-2	O.D 34.0 ~ 114.3 mm	1 Line	-	KIESERLING	KUNSAN
4-3	O.D 34.0 ~ 60.5 mm	1 Line	-	MANNESMANN	KUNSAN
4-4	O.D 114.3 ~ 216.3 mm	1 Line	-	SeAH	KUNSAN
5. Galvanizing					
5-1	O.D 21.7 ~ 165.2 mm	1 Line	-	TAEJONG	KUNSAN
5-2	O.D 76.3 ~ 609.6 mm	1 Line	-	TAEJONG	KUNSAN

SěAH

PRODUCT LIST

- Korean Industrial Standards
- Japanese Industrial Standards
- British Standards
- Deutsch Industrie Norman
- Australian Standards
- Canadian Standards Association Standards
- American Petroleum Institute Standards
- American Society for Testing & Material Standards
- American National Standards Institute Standards
- American Bureau of Shipping Standards
- Lloyd's Register of Shipping Standards
- Det Norske Veritas Standards
- Underwriters Laboratories Inc.

Ordinary Piping	• Pipes for Water Piping • Pipes for General Ordinary Piping	KS JIS BS ASTM ISO DIN AS
Oil Country Tubular Goods	• Casing & Tubing	API 5CT
Line Pipe	• Onshore Line Pipe • Offshore Line Pipe	API 5L
Conduit Tubes	• Electric Metallic Tubing	KS JIS UL CSA ANSI

Pressure Service	• Pipes for Pressure Service	KS JIS
Structural Purpose	• Offshore Structure Pipe • Tubes for General Structural Purpose • Tubes for Mechanical Structural Purpose • Fence Tubes • Posts for Green House • Steel Pipe Pile	KS JIS ASTM API 2B DIN AS
Spiral Welded Pipe	• Asphalt Coating Pipe • Coal-Tar Enamel Coating Pipe • Bare Spiral Pipe	KS JIS ASTM BS AS
Heat Transfer	• Boiler Tues • Heat Exchanger Tubes	KS JIS ASTM
Square & Rectangular Tubes	• Tubes forGeneral & Mechanical Structural Purpose	KS JIS ASTM AS
Tubular Steel Pole	• Transmission Pole • Lighting Pole	

V. MAN□ □ACT□ RING □ INSPECTION PROCESS

- Please refer to the I. T. P

VI. TESTING □ INSPECTING APPARAT□ S

POHANG PLANT

NO.	ITEMS	ABILITY	ORIGIN	COUNT
1.	UNIVERSAL TESTING MACHINE	MAX 50 ton MAX 100 ton	JAPAN JAPAN	1 SET 1 SET
2.	CHARPY IMPACT TESTER	542 J	GERMANY	1 EA
3.	CHARPY NOTCH BROACHING MACHINE	45° ± 1°	ENGLAND (BLACKS)	2EA
4.	SPECTROMETER	22 CHANNEL	U.S.A	1 EA
5.	NITROGEN/OXYGEN DETERMINATOR	0.5ppm~3.0%	U.S.A(LECO)	1 EA
6.	HARDNESS TESTER -ROCKWEL -EQUO TIP -VICKERS	 MAX 250kg MAX 940 Hv 30kg	 GERMANY SWISS U.S.A	 1 EA 1 EA 1 EA
7.	BENDING M/C	MAX 6"	KOREA	1 EA
8.	FLATTENING TESTER	30, 50,200ton	KOREA	4 SETS
9.	DROP WEIGHT TEAR TESTER	700kg	KOREA	1 EA
10.	RING EXPANSION TESTER	14", 20", 24"	KOREA	3 SETS
11.	HIC TESTER	—	KOREA	3 SET
12.	SSCC(CLT) TESTER SSCC(FPBT)	6000 kg. f	KOREA KOREA	3 SET 2 SET
13.	POTENTIOSTAT	MAX 1A, 3 V	KOREA	1 SET
14.	PH METER	0-14	U.S.A	1 EA
15.	SALT SPARY TESTER	—	KOREA	1 EA

NO.	ITEMS	ABILITY	ORIGIN	COUNT
16.	TEMP & HUMIDITY CHAMBER	-40 ~+80℃ 35% ~ 98% RH	KOREA	1 SET
17.	AUTOTEMP BATH	100℃	KOREA	1 EA
18.	MICRO SCOPE	3.15X ~ 40X	GERMANY	1 EA
19.	PROFILE PROJECTOR	X10-X100	JAPAN	4 EA
20.	POLISHER M/C	1/4HP	U.S.A	2 EA
21.	METALLURGICAL MICROSCOPE	3.15X ~ 40X 12.5X ~ 1,000X	GERMANY GERMANY	1 EA 1 EA
22.	MOUNTING PRESS	—	U.S.A	2 EA
23.	MUFFLE FURNACE	MAX 1600℃	KOREA	1 EA
24.	BURST / COLLAPSE TESTER	1000kg/cm²	KOREA	1 SET
25.	HYDROSTATIC TESTER	O.D ½" ~ 4" MAX 211 kg/cm²	KOREA	1 SET
		O.D 2⅜" - 8⅝" MAX 850kg/cm²	GERMANY	1 SET
		O.D 6" ~ 20" MAX 281kg/cm²	U.S.A	1 SET
		O.D 8" - 24" MAX 500kg/cm²	JAPAN	1 SET
		O.D 22" ~ 60" MAX 255kg/cm²	GERMANY	1 SET
26.	DEAD WEIGHT TESTER	500kg/cm²	JAPAN	2 EA

NO.	ITEMS	ABILITY	ORIGIN	COUNT
27.	EDDY CURRENT TESTER	MAX 6"	GERMANY	10 SETS
28.	ULTRASONIC THICKNESS TESTER	0.01~ 99mm	JAPAN	3 SETS
29.	RADIOGRAPHIC TESTER	225KV30mA (22" ~ 80")	DENMARK	2 SETS
		260KV 5mA	JAPAN	1 SET
30.	MAGNETIC PARTICLE TESTER	AC100V/60Hz, 35A	KOREA	4 SETS
31.	ULTRASONIC TESTER			
	-SKELP U/T	100mm-1900mm (16 CHANNEL)	GERMANY	1 SET
	-ON LINE U/T	O.D2" ~ 6"		1 EA
		O.D 3" ~ 8"		1 EA
		O.D 8" - 20"		1 EA
		O.D 12" ~ 24"		1 EA
	-OFF LINE SEAM U/T	O.D 3" ~ 8"		1 SET
		O.D 8" ~ 20"		1 SET
		O.D 8" ~ 24"		1 SET
		O.D 22" ~ 60"		1 SET
	-OFF LINE FULL BODY U/T	O.D 8" ~ 24"		1 SET
		O.D 19 mm ~ 89.1mm		1 SET
	-MANUAL U/T	—	GERMANY	5 SETS
32.	MONOPAN ANALYTICAL BALANCE	0.1~ 200g	GERMANY	1 EA
33.	TOP LOADING PRECISION BALANCE	0.1~ 1600g	KOREA	1 EA
34.	TRUCK SCALE	10 ~ 50,000kg	KOREA	1 SET
	WEIGHTING MACHINE	1, 3, 5, 30ton		4 SETS

SUNCHEON PLANT

NO.	IEQUIPMENT NAME	ABILITY	ORIGIN	COUNT
1.	Chemical Analysis Spectrometer	22 elements	Shimadzu(Japan)	1
2.	Universal Test Machine	1000 kN	Kyoung Sung(Korea)	1
3.	Charpy Impact Tester	50kgf.m(500J)	Kyoung Sung(Korea)	1
4.	Wrap-around Bending Machine	ø 30.5 ~ ø 383.5	Dainsystec(Korea)	1
5.	Vickers Hardness Tester	8 Step(1~50kgf)	MATSUZAWA	1
6.	Auto Radioactive Tester (Film Type X-ray)	320kv 13mA 2Set	GE(Germany)	1
7.	Auto Radioactive Tester (Real Time X-ray)	225kv 15mA	YXLON(U.S.A)	1
8.	Auto Ultrasonic Tester (Longitudinal Seam U.T)	22Probe 28Channel	GE(Germany)	1
9.	Auto Ultrasonic Tester (On-line Helical Seam U.T)	6Probe 6Channel	Sofratest(France)	1
10.	Auto Ultrasonic Tester (Off-line Helical Seam U.T)	16Probe 16Channel	Sofratest(France)	1
11.	Gauss Meter	300G	FW Bell(U.S.A)	1
12.	Macrographic and Metallographic testing	Resolution: 1280x1024	Olympus(Japan)	1
13.	Micrometer	25,50,75,100mm	Mitutoyo(Japan)	1
14.	Ultrasonic Thickness Gauge	1~152mm (0.04"" to 6.0"")	Elcometer(England)	1
15.	Hydrostatic Tester (Press Bending)	30 Mpa(300 bar)	Sogang(Korea)	1
16.	Hydrostatic Tester (Spiral)	25 Mpa(250 bar)	Jae Won(Korea)	1

KUNSAN PIPE PLANT

NO.	IEQUIPMENT NAME	ABILITY	ORIGIN	COUNT
1.	Universal Test M/C	50 Ton	JAPAN	1
2.	Spectrometer (Vacuum type)	-	JAPAN	1
3.	Bending Test M/C	15A~50A	KOREA	1
4.	Flattening Tester M/C	30~100 Ton	KOREA	4
5.	Eddy Current Test M/C	10 KHz 1000 KHz	USA GERMANY	1 3
6.	Ultrasonic Test M/C	20 MHz	GERMANY	1
7.	Rockwell Hardness Tester	HRB 100 Kgf HRC 150 Kgf	JAPAN	1
8.	Merallurgical Microscope	100x~600x	KOREA	1
9.	Metal-Flow M/C		JAPAN	1

VII. APPROVED CERTIFICATES

CERTI□ICATES

APPROVE□ VEN□OR □IST

QUALITY CERTIFICATE STATUS

POHANG PLANT

Cert. Description	Product	Date	Monogram
International Standardization Organization	- ISO 9001 Quality System(Carbon Steel Pipe) - ISO 14001 Environmental Management System - OHSAS 18001 Health & Safety Management System	1993. 01.19. 1997. 08. 21. 2010. 09. 01.	ISO (DNV)
Korea Industrial Standards	- Rigid Steel Conduits - Carbon Steel Pipe for Ordinary Piping - Arc Welded Carbon Steel Pipe - Steel Pipe Piles - Carbon Steel Tubes for Boiler & Heat Exchanger - Carbon Steel Pipes for Pressure Service - Carbon Steel Tubes for Machine Structural Purposes - Carbon Steel Tubes for General Structural Purposes - Carbon Steel Square Pipes for General Structural Purposes - Carbon Steel Pipes for Fuel Gas Piping - Steel Pipe Sheet Piles	1965. 03. 17. 1979. 09. 22. 1980. 07. 30. 1980. 07. 30. 1980. 10. 13. 1980. 12. 29. 1981. 08. 10. 1983. 11. 18. 1985. 08. 02. 1999. 06. 26. 2000. 01. 14.	KS
Japan Industrial Standards	- Carbon Steel Pipe for Ordinary Piping - Carbon Steel Pipes for Pressure Service - Arc Welded Carbon Steel Pipe - Carbon Steel Boiler & Heat Exchanger Tubes - Carbon Steel Tubes for Machine Structural Purposes - Carbon Steel Tubes for General Structural Purposes - Carbon Steel Square Pipes for General Structural Purposes - Rigid Steel Conduits - Steel Pipe Piles - Steel Pipe Sheet Piles	1983. 06. 13. 1983. 06. 13. 1994. 08. 10. 1983. 06. 13. 1986. 03. 17. 1986. 03. 17. 1986. 03. 17. 1987. 08. 03. 1994. 08. 10. 1999. 08. 04.	JIS
Underwriters Laboratories INC.	- Rigid ferrous Metal Conduit	1982. 10. 05.	UL
National Sanitation Foundation	- ANSI/NSF Standard 61:Drinking Water System (ASTM A53 Galvanized Pipes)	1998. 02. 02.	UL (NSF)
American Petroleum Institute	- 5L Line Pipe - 5CT Casing & Tubing - 2B Structural Steel Pipe	1979. 03. 21. 1979. 03. 21. 1995. 07. 24.	API

Cert. Description	Product	Date	Monogram
Korea Register of Shipping	- Steel Tubes for Boiler & Heat Exchanger - Steel Pipes for Pressure Piping	1997. 09. 26.	KR
Lioyds Register of Shipping	- Welded Steel Pipes & Tubes	1999. 09. 23.	LIOYDS
Det Norske Veritas	- Steel Pipes & Tubes	1981. 03. 11.	DNV
Bureau Veritas	- ERW Carbon-Manganese Steel Tubes for Pressure Piping - SAW Carbon-Manganese Steel Pipes for Pressure Piping - WORKS APPRPVAL(ERW: 19-609.6mm, SAW: 20″-54″)	1998. 05. 11. 2000. 03. 14. 2000. 04. 10.	BV
Nippon Kaiji Kyokai	- Welded Steel Pipes STPG38-E-G, STPG38-E-H - Welded Steel Tubes for Boiler & Heat Exchanger STB35	1996. 06. 25. 1997. 06. 24.	NK
Germanischer Lioyd	- Longitudinal Welded Carbon Steel Pipes grade STPG 370	2000. 06. 23.	GL
Registro Italiano Navale	- Steel Pipes for Pressure Vessl - Steel Tubes and Pipes for Boiler & Heat Exchanger	2000. 02. 28.	RINA
Canadian Standards Association	- Conduit Tube	1986. 12. 10.	CSA

SUNCHEON PLANT

Cert. Description	Product	Date	Monogram
International Standardization Organization	- ISO 9001 Quality System(Carbon Steel Pipe) - IISO/TS 29001 Quality System (Petrochemical Sector) - ISO 14001 Environmental Management System - OHSAS 18001 Health & Safety Management System	2010.11.01. 2010.11.01 2011.04.11 2011.04.11.	ISO
Korea Industrial Standards	- Arc Welded Carbon Steel Pipes - Steel Pipe Piles - Carbon Steel Tubes for General Structural Purposes	2011.02.09. 2011.02.09 2011.02.09.	KS
Japan Industrial Standards	- Arc Welded Carbon Steel Pipes - Steel Pipe Piles - Carbon Steel Tubes for General Structural Purposes	2011.06.17. 2011.06.17 2011.06.17.	JIS
American Petroleum Institute	- 5L Line Pipe - 2B Structural Steel Pipe - Q1 (Quality System)	2010.11.01. 2010.11.01 2010.11.01.	API

KUNSAN PIPE PLANT

Cert. Description	Product	Date	Monogram
International Standardization Organization	- ISO 9001 Quality System(Carbon Steel Pipe)	2006.12.15.	ISO
Korea Industrial Standards	- Carbon Steel Pipe for Ordinary Piping	1993.01.14.	KS
	- Carbon Steel Pipes for Pressure Service	2005.10.11.	
	- Carbon Steel Tubes for General Structural Purpose	1992.09.22.	
	- Carbon Steel Square Pipes for General Structural Purpose	1993.01.14.	
	- Carbon Steel Pipes for Fuel Gas Piping	2009.09.23.	
	- Rigid Steel Conduits	2012.04.18.	
Japan Industrial Standards	- Carbon Steel Pipes for Pressure Service	2010.05.28.	JIS
	- Carbon Steel Pipe for Ordinary Piping - Carbon Steel Tubes for General Structural Purpose - Carbon Steel Square Pipes for General Structural Purpose	2011.02.14.	
Germanischer Lloyd	- Carbon Steel Pipes for Pressure Service	2011.03.21.	GL
Det Norske Veritas	- Carbon Steel Pipes for Pressure Service	2011.03.24.	DNV
Bureau Veritas	- Carbon Steel Pipes for Pressure Service	2011.05.11.	BV
Lloyd Register	- Carbon Steel Pipes for Pressure Service	2012.01.03.	LR

SeAH Steel

Contact SeAH Tower, 45 Yangnwa-ro, Mapo-gu, Seoul 121-841, Korea
TEL : +82-2-6970-1067,1078,1086 / E-mail : export@seahsteel.co.kr / www.seahsteel.com

REVISION No.6 2013.05.06

RANGER COUPLINGS

RANGER COUPLING

Klamflex Ranger Couplings are designed to join pipes of various outside diameters with the same or different nominal bore. Ranger Couplings can be used as a Straight or Step Coupling.

Sizes: 50 - 600NB
Max Working Pressure 16 Bar

RANGER COUPLING WITH STAINLESS STEEL SLEEVE

Klamflex Ranger Couplings SS are designed with a stainless steel sleeve and epoxy coated end rings, the sleeve which comes into contact with the liquid is manufactured from 316 stainless steel and can be used where the media is extremely corrosive.

Sizes: 50 - 300NB
Max Working Pressure 16 Bar

RANGER END CAP

Klamflex Ranger End Caps are manufactured from Ranger Couplings providing the versatlity of using them on a variety of different pipe materials and outside diameters

Sizes: 50 - 300NB
Max Working Pressure 16 Bar

NOM.BORE (mm/inch)	PIPE O.D. RANGE(mm)	APPROX MASS (kg)	PIPE MATERIAL SUITABILITY
50/2	59-72	3	STEEL (imperial+metric), UPVC, DI, CI, AC (imperial), ABS/DWV
65/2.5	72-85	3	STEEL (imperial+metric), UPVC, DI, CI, AC (imperial), ABS/DWV
80/3	88-103	4	STEEL (imperial+metric), UPVC, DI, CI, AC (imperial), ABS/DWV
100/4	109-128	5	STEEL (imperial+metric), UPVC, DI, CI, AC (cod), AC (imperial)
125/5	138-153	5	STEEL (imperial+metric), UPVC, DI, CI, AC (cod), AC (imperial)
150/6	159-182	7	STEEL (imperial+metric), UPVC, DI, CI, AC (cod), AC (cid), AC (imperial)
175/7	192-210	9	STEEL (imperial+metric), UPVC, CI, AC (imperial)
200/8	218-235	10	STEEL (imperial+metric), UPVC, DI, CI, AC (cod), AC (cid), AC (imperial), GRP
200/8	242-262	13	UPVC, AC (cid)
225/9	230-247	17	STEEL (imperial+metric), DI, AC (cod), AC (cid), AC (imperial)
250/10	250-267	18	STEEL (imperial+metric), UPVC, AC (cid)
250/10	272-289	16	STEEL (imperial+metric), UPVC, DI, CI, AC (cod), AC (cid), AC (imperial), GRP
300/12	315-332	24	STEEL (imperial+metric), UPVC, DI, GRP
300/12	322-340	20	STEEL (imperial+metric), DI, AC Class 12
300/12	340-360	17	UPVC, DI, AC (cod), AC (cid), AC (Metric), CI
350/14	351-378	17	STEEL (imperial+metric), UPVC, AC (cid), AC (metric), CI
350/14	374-391	28	DI, GRP, AC Class 6
400/16	390-410	18	STEEL (imperial+metric), UPVC, AC (cid), AC (metric), CI
400/16	417-437	26	DI, AC Class 6 and 12
450/18	454-460	39	STEEL (imperial+metric), AC (metric)
450/18	480-500	33	DI, AC Class 6 and 12, UPVC
500/20	526-546	35	DI, AC Class 6 and 12
600/24	600-630	62	STEEL (imperial+metric), GRP, CI
600/24	630-650	47	DI, AC Class 6, Imperial CI/CL

DEDICATED COUPLING

Klamflex Dedicated Couplings join pipes of the same outside diameter, couplings up to 324mm OD are delivered pre-assembled, larger sizes are delivered ready for site assembly.

Sizes: 50-2000NB (Please contact Klamflex for sizes above 2000NB)
Working Pressure 16 Bar (Please consult Klamflex for higher pressures)

KLAMFLEX DEDICATED COUPLINGS
DUCTILE IRON PIPE ISO 2531:1991 BS 4772:1988

FOR 10 & 16 BAR WORKING PRESSURE

NOM BORE (mm)	PIPE OD (mm)	TOLERANCE ON PIPE OD FOR PREPARED END (mm)		MINIMUM PIPE END PREPARED LENGTH L (mm)	OD OF ENDRING A (mm)	COUPLING LENGTH B (mm)	SLEEVE WIDTH D (mm)	STANDARD TEST PRESSURE AT: 10 bar working pressure	STANDARD TEST PRESSURE AT: 16 bar working pressure	APPROX. MASS (kg)
80	98	+1.0	-3.0	100	158	178	102	15	24	4
100	118	+1.0	-3.0	100	200	178	102	15	24	4
125	141	+1.0	-3.0	100	220	178	102	15	24	6
150	170	+1.0	-3.0	100	260	178	102	15	24	6
200	222	+1.0	-3.5	100	308	178	102	15	24	8
250	274	+1.0	-3.5	100	364	178	102	15	24	11
300	326	+1.0	-3.5	100	414	178	102	15	24	12
350	378	+1.0	-3.5	150	480	262	178	15	24	29
400	429	+1.0	-4.0	150	531	262	178	15	24	34
450	480	+1.0	-4.0	150	582	262	178	15	24	37
500	532	+1.0	-4.0	150	634	262	178	15	24	41
600	635	+1.0	-4.5	150	737	262	178	15	24	48
700	738	+1.0	-4.5	150	840	262	178	15	24	56
800	842	+1.0	-4.5	150	944	262	178	15	24	64
900	945	+1.0	-5.0	150	1047	262	178	15	24	71
1000	1048	+1.0	-5.0	150	1150	262	178	15	24	78
1100	1152	+1.0	-6.0	150	1268	262	178	15	24	115
1200	1255	+1.0	-6.0	150	1371	262	178	15	24	125
1400	1468	+1.0	-6.0	150	1578	262	178	15	24	144
1600	1668	+1.0	-6.0	150	1784	262	178	15	24	164
1800	1875	+1.0	-6.0	150	1989	262	178	15	24	TBA
2000	2082	+1.0	-6.0	150	2196	262	178	15		TBA

DEDICATED COUPLING

KLAMFLEX DEDICATED COUPLINGS
STEEL PIPES: ISO 2531:1991 BS 4772:1988

FOR 10 & 16 BAR WORKING PRESSURE

NOM BORE (mm)	PIPE OD (mm)	TOLERANCE ON PIPE OD FOR PREPARED END (mm)		MINIMUM PIPE END PREPARED LENGTH L (mm)	OD OF ENDRING A (mm)	COUPLING LENGTH B (mm)	SLEEVE WIDTH D (mm)	STANDARD TEST PRESSURE AT: 10 bar working pressure	16 bar working pressure	APPROX. MASS (kg)
50	60.3	+0.8	-0.8	100	134	178	83	15	24	2
65	76.1	+0.8	-0.8	100	150	178	102	15	24	3
80	88.9	+0.8	-0.8	100	158	178	102	15	24	3
100	114.3	+0.8	-0.8	100	174	178	102	15	24	4
125	139.7	+1.6	-0.8	100	220	178	102	15	24	6
150	165.1	+1.6	-0.8	100	246	178	102	15	24	5
150	168.3	+1.6	-0.8	100	246	178	102	15	24	5
200	219.1	+1.6	-0.8	100	308	178	102	15	24	8
225	244.5	+1.6	-0.8	100	338	178	102	15	24	11
250	267	+1.6	-0.8	100	360	178	102	15	24	11
250	273	+1.6	-0.8	100	364	178	102	15	24	11
300	323.9	+1.6	-0.8	100	414	178	102	15	24	12
350	355.6	+1.6	-1.6	150	458	262	178	15	24	28
400	406.4	+1.6	-1.6	150	509	262	178	15	24	31
450	457	+1.6	-1.6	150	559	262	178	15	24	36
500	508	+1.6	-1.6	150	610	262	178	15	24	40
550	559	+1.6	-1.6	150	661	262	178	15	24	43
600	609.6	+1.6	-1.6	150	712	262	178	15	24	46
650	660	+1.6	-1.6	150	762	262	178	15	24	49
700	711.2	+1.6	-1.6	150	814	262	178	15	24	54
750	762	+1.6	-1.6	150	864	262	178	15	24	58
800	812.8	+1.6	-1.6	150	915	262	178	15	24	61
850	864	+1.6	-1.6	150	966	262	178	15	24	65
900	914.4	+1.6	-1.6	150	1017	262	178	15	24	69
950	965	+1.6	-1.6	150	1067	262	178	15	24	73
1000	1016	+1.6	-1.6	150	1118	262	178	15	24	76
1050	1067	+1.6	-1.6	150	1169	262	178	15	24	79
1100	1118	+1.6	-1.6	150	1220	262	178	15	24	84
1200	1219	+1.6	-1.6	150	1335	262	178	15	24	122
1200	1235	+1.6	-1.6	150	1351	262	178	15	24	123
1400	1420	+1.6	-3	150	1536	262	178	15	24	140
1400	1422	+1.6	-3	150	1538	262	178	15	24	141
1500	1520	+1.6	-3	150	1636	262	178	15	24	150
1600	1620	+3	-3	150	1736	262	178	15	24	160
1600	1626	+3	-3	150	1742	262	178	15	24	161
1800	1820	+3	-3	150	1936	262	178	15	24	179
1800	1829	+3	-3	150	1945	262	178	15	24	179
2000	2020	+3	-3	150	2134	262	178	15		TBA

RANGER FLANGE ADAPTOR

Klamflex Ranger Flange Adaptors are designed to join pipes of various outside diameters to flanged valves, pumps, flow meters, flanged pipes and fittings. Ranger Flange Adaptors are manufactured using a multi drilled flange to accommodate most drilling tables.

Sizes 50 - 600NB
Max Working Pressure 16 Bar

NOM. BORE (mm/inch)	PIPE O.D. RANGE (mm)	APPROX MASS (kg)	FLANGE DRILLING COMPATIBILITY
50/2	59-72	3	BS 10 Table D,E, & F: ANSI 150: BS4504: 6/3, 10/3, 16/3 SABS 1123: 600/3, 1000/3, 1600/3
65/2.5	72-85	4	BS 10 Table F: BS4504:10/3, 16/3: SABS 1123:1000/3, 1600/3
80/3	88-103	5	BS 10 Table D,E, & F: ANSI 150: BS4504: 6/3, 10/3, 16/3 SABS 1123: 600/3, 1000/3, 1600/3
100/4	109-128	5	BS 10 Table D,E, & F: ANSI 150: BS4504:10/3, 16/3 SABS 1123: 1000/3, 1600/3
125/5	138-153	7	BS 10 Table D,E, & F: ANSI 150: BS4504: 6/3, 10/3, 16/3 SABS 1123: 600/3, 1000/3, 1600/3
150/6	159-182	8	BS 10 Table D & E: ANSI 150: BS4504: 10/3, 16/3 SABS 1123: 1000/3, 1600/3
175/7	192-210	9	BS 10 Table D & E: ANSI 150: BS4504: 10/3, 16/3 SABS 1123: 1000/3, 1600/3
200/8	218-235	10	BS 10 Table D & E: ANSI 150: BS4504: 10/3, 16/3 SABS 1123: 1000/3, 1600/3
200/8	242-262	14	BS4504 16/3
250/10	250-267 272-289	16 15	BS 10 Table E: BS4504: 10/3, 16/3. SABS 1123: 1000/3, 1600/3
300/12	315-332	22	PN 10, PN 16, TABLE D & E
300/12	322-340	19	PN 10, PN 16, TABLE E, ANSI 150 lb
350/14	351-378	29	BS4504 16/3
350/14	374-391	25	PN 10, PN 16
400/16	417-437	29	PN 10, PN 16
450/18	480-500	33	PN 10, PN 16
500/20	526-546	41	PN 10, PN 16, ANSI 150 lb
600/24	630-650	51	PN 10, PN 16, ANSI 150 lb

GRIPPER FLANGE ADAPTOR

Klamflex Gripper Flange Adaptors are designed to resist end pullout on PE and HDPE pipes, it is the fastening action of the Gripper Ring that secures the Flange Adaptor onto the pipe resisting end pullout.
Sizes: 50 - 300NB
Max Working Pressure 16 Bar

NOMINAL BORE (mm)	PIPE OD RANGE (mm)	APPROX MASS (kg)	FLANGE DRILLING
50	63	4	PN10/16
80	90	5	PN10/16
100	110	6	PN10/16
150	160	13	PN10/16
150	180	13	PN10/16
200	200	16	PN10/16
200	225	18	PN10/16
250	250	25	PN16
250	280	28	PN16
300	315	38	PN16

DEDICATED FLANGE ADAPTOR

Klamflex Dedicated Flange Adaptors are manufactured to join plain ended pipe to flanged valves, pumps, flow meters, flanged pipes and fittings. The thickness of the flanges will not necessarily be the same as the mating flange due to the fact that the flange of the Flange Adaptor will not be subject to the full end or side thrust, most of which is absorbed by the flexibility of the rubber gasket. **Dedicated Flange Adaptors can also be restrained to alleviate end pullout.**

Sizes: 50 - 2000NB (Please consult Klamflex for sizes above 2000NB)
Working Pressure 16 Bar (Please consult Klamflex for higher pressures)

KLAMFLEX FLANGE ADAPTORS: DUCTILE IRON PIPES
FLANGES DRILLED PN10 OR PN16, 1000/3 OR 1600/3 (BS10: A,D,E) AND ANSI 125/ 150

NOM BORE (mm)	PIPE OD (mm)	TOLERANCE ON PIPE OD FOR DISTANCE L (mm)		MINIMUM LENGTH PREPARED PIPE END L (mm)	OD OF ENDRING A (mm)	FLANGE ADAPTOR LENGTH B (mm)	TABLE FLANGE THICKNESS T (mm)	APPROX. MASS (kg)
100	118	+1.0	-3.0	100	200	102	12	5
150	170	+1.0	-3.0	100	260	106	16	8
200	222	+1.0	-3.5	100	308	106	16	10
250	274	+1.0	-3.5	100	364	109	19	15
300	326	+1.0	-3.5	100	414	109	19	17
350	378	+1.0	-3.5	150	480	153	23	32
400	429	+1.0	-4.0	150	531	154	24	38
450	480	+1.0	-4.0	150	582	154	24	43
500	532	+1.0	-4.0	150	634	155	25	53
600	635	+1.0	-4.5	150	737	155	25	67
700	738	+1.0	-4.5	150	840	155	25	67
800	842	+1.0	-4.5	150	944	155	25	78
900	945	+1.0	-5.0	150	1047	155	25	82
1000	1048	+1.0	-5.0	150	1150	157	27	109
1200	1255	+1.0	-6.0	150	1371	165	35	180
1400	1462	+1.0	-6.0	150	1578	175	45	244
1600	1668	+1.0	-6.0	150	1784	190	60	383
1800	1875	+1.0	-6.0	150	1989	190	60	TBA
2000	2082	+1.0	-6.0	150/300	2196	190/290	60	TBA

DEDICATED FLANGE ADAPTOR

KLAMFLEX FLANGE ADAPTORS : STEEL PIPES
FLANGES DRILLED PN10 OR PN16, 1000/3 OR 1600/3 (BS10: A,D,E) AND ANSI 125/ 150

NOM BORE (mm)	PIPE OD (mm)	TOLERANCE ON PIPE OD FOR DISTANCE L (mm)		MINIMUM LENGTH PREPARED PIPE END L (mm)	OD OF ENDRING A (mm)	FLANGE ADAPTOR LENGTH B (mm)	TABLE FLANGE THICKNESS T (mm)	APPROX. MASS (kg)
50	60.3	+0.8	-0.8	100	134	152	12	3
65	76.1	+0.8	-0.8	100	150	102	12	3
80	88.9	+0.8	-0.8	100	165	102	12	4
100	114.3	+0.8	-0.8	100	191	102	12	5
125	139.7	+1.6	-0.8	100	220	104	14	7
150	165.1	+1.6	-0.8	100	246	106	16	8
150	168.3	+1.6	-0.8	100	246	106	16	8
200	219.1	+1.6	-0.8	100	308	106	16	10
250	267	+1.6	-0.8	100	360	109	19	16
250	273	+1.6	-0.8	100	364	109	19	15
300	323.9	+1.6	-0.8	100	414	109	19	17
350	355.6	+1.6	-1.6	150	458	153	23	34
400	406.4	+1.6	-1.6	150	509	154	24	40
450	457	+1.6	-1.6	150	559	154	24	46
500	508	+1.6	-1.6	150	610	155	25	56
600	610	+1.6	-1.6	150	712	155	25	71
700	711	+1.6	-1.6	150	813	155	25	72
800	813	+1.6	-1.6	150	915	155	25	84
900	914	+1.6	-1.6	150	1016	155	25	90
1000	1016	+1.6	-1.6	150	1118	157	27	119
1200	1219	+1.6	-1.6	150	1335	165	35	198
1400	1420	+1.6	-3	150	1536	175	45	276
1600	1620	+3	-3	150	1736	190	60	439
1800	1820	+3	-3	150	1936	190	60	494
2000	2020	+3	-3	150/ 300	2134	190/ 290	60	TBA
2000	2032	+3	-3	150/ 300	2146	190/ 290	60	TBA

KLAMFLEX STEPPED FLANGE ADAPTOR

KLAMFLEX Stepped Flange Adaptors can be manufactured where pipe nominal bore is larger (as indicated above) or smaller than flange nominal bore.

KLAMFLEX RESTRAINED FLANGE ADAPTOR

KLAMFLEX Restrained Flange Adaptors can be manufactured for steel pipes where end pullout is of concern. Restraining Flange and Tie Rods will be supplied with the Flange Adaptor

DISMANTLING JOINT

Klamflex Dismantling Joints are a double flanged composite fitting featuring a telescopic action between a flanged spigot and flange adaptor. The joint is designed to provide longitudinal adjustment in flanged pipe systems. Dismantling Joints provide a simple method for the installation and removal of flanged valves, pumps, flow meters, flanged pipes and pipe fittings.

Sizes: 50 - 2000NB (Please consult Klamflex for sizes above 2000NB)
Working Pressure 16 Bar (Please consult Klamflex for higher pressures)

NOMINAL BORE OF JOINT (mm)	FLANGE PN RATING (bar)	SPIGOT PIPE O.D. +/- (mm)	SPIGOT PIPE WALL THICK (mm)	C SPIGOT LENGTH INCLUDING FLANGE (mm)	B ADAPTOR & SPIGOT FLANGE THICKNESS (mm)	H MIN LENGTH OF JOINT (mm)	C + D RECOM. JOINT LENGTH	H MAX LENGTH OF JOINT (mm)	TIE ROD QTY	L	X	A TIE ROD LENGTH (mm)	APPROX MASS (kg)
50	PN 10/16	60	3.2	165	12	165	185	205	4	M16	X	300	9
65	PN 10/16	76	3.2	165	12	165	185	205	4	M16	X	300	10
80	PN 10/16	89	3.2	165	12	165	185	205	4	M16	X	300	12
100	PN 10/16	114	3.9	165	12	165	185	205	4	M16	X	300	13
125	PN 10/16	140	4.2	165	14	165	185	205	4	M16	X	300	16
150	PN 10/16	165	4.2	165	16	165	185	205	4	M20	X	320	23
200	PN 10	219	4.5	165	16	165	185	205	4	M20	X	320	31
200	PN 16	219	4.5	165	16	165	185	205	4	M20	X	320	33
250	PN 10	273	4.5	175	19	175	195	215	4	M20	X	330	34
250	PN 16	273	4.5	175	19	175	195	215	4	M24	X	350	38
300	PN 10	324	4.5	175	19	175	195	215	4	M20	X	330	43
300	PN 16	324	4.5	175	19	175	195	215	4	M24	X	350	44
350	PN 10	356	4.5	250	23	250	275	300	4	M20	X	420	49
350	PN 16	356	4.5	250	23	250	275	300	4	M24	X	450	71
400	PN 10	406	4.5	250	24	250	275	300	4	M24	X	450	77
400	PN 16	406	4.5	250	24	250	275	300	4	M27	X	460	88
450	PN 10	457	4.5	250	24	250	275	300	4	M24	X	450	95
450	PN 16	457	4.5	250	24	250	275	300	4	M27	X	470	99
500	PN 10	508	4.5	250	25	250	275	300	4	M24	X	450	111
500	PN 16	508	4.5	250	25	250	275	300	4	M30	X	490	131
600	PN 10	610	4.5	250	25	250	275	300	4	M27	X	480	135
600	PN 16	610	4.5	250	25	250	275	300	4	M33	X	520	175
700	PN 10	711	6.0	250	25	250	275	300	4	M27	X	480	168
700	PN 16	711	6.0	250	25	250	275	300	4	M33	X	520	184
800	PN 10	813	6.0	250	25	250	275	300	4	M30	X	500	200
800	PN 16	813	6.0	250	25	250	275	300	6	M36	X	550	220
900	PN 10	914	6.0	250	25	250	275	300	7	M30	X	510	225
900	PN 16	914	6.0	250	25	250	275	300	7	M36	X	570	245
1000	PN 10	1016	6.0	260	27	260	290	320	7	M33	X	560	298
1000	PN 16	1016	6.0	260	27	260	290	320	7	M39	X	610	331
1200	PN 10	1219	8.0	280	35	280	310	340	8	M36	X	610	496
1200	PN 16	1219	8.0	280	35	280	310	340	8	M45	X	680	559
1400	PN 10	1420	8.0	310	45	310	340	370	9	M39	X	670	610
1400	PN 16	1420	10.0	310	45	310	340	370	9	M45	X	730	665
1600	PN 10	1620	10.0	350	60	350	380	410	8	M45	X	750	1250
1600	PN 16	1620	10.0	350	60	350	380	410	8	M52	X	820	1320
1800	PN 10	1820	10.0	350	60	350	380	410	11	M45	X	770	1300
1800	PN 16	1820	10.0	350	60	350	380	410	11	M52	X	850	1500
2000	PN 10	2020	12.0	350	60	350	380	410	12	M45	X	750	1490
2000	PN 16	2020	12.0	350	60	350	380	410	12	M56	X	890	1750

Drive Technical Data Sheet

Item No. 1.1.1

ACS800-37-0510-3

Specifications		Catalogue data	
Name	350KW Motor		
No.of Inverters	1	Voltage [V]	400
Type	ACS800 low harmonic	Nominal power [kW]	355
Construction	Cabinet	Nominal current [A]	701
Cooling	Air	Imax [A]	1000
IP Class	IP54R	Ihd [A]	546
Pulse	6-pulse	Pulse	6
		Frame type	R8i
		Icont max [A]	730

Inverter load

Load type	Pump/fan load	
Overload type	Simple cyclic	
Icont [A]	546	540s
Imax [A]	589	60s
cosfii		

Calculations

	Required	Result	Margin
Limit			
Icont [A]	546	730	N/A
Imax [A]	589	1000	70 %
Pmax kW	347	692	99 %
Temperature			16 %

Selection method: IGBT temperature

Graph: currents

ABB

Drive Technical Data Sheet

Item No. 1.1.2

ACS800-37-0640-3

Specifications		Catalogue data	
Name	400KW Motor		
No.of Inverters	1	Voltage [V]	400
Type	ACS800 low harmonic	Nominal power [kW]	500
Construction	Cabinet	Nominal current [A]	882
Cooling	Air	Imax [A]	1258
IP Class	IP54R	Ihd [A]	688
Pulse	6-pulse	Pulse	6
		Frame type	2xR8i
		Icont max [A]	919

Inverter load

Load type	Pump/fan load	
Overload type	Simple cyclic	
Icont [A]	623	540s
Imax [A]	671	60s
cosfii		

Calculations

	Required	Result	Margin
Limit			
Icont [A]	623	919	N/A
Imax [A]	671	1258	87 %
Pmax kW	395	904	129 %
Temperature			27 %

Selection method: IGBT temperature

Graph: currents

Drive Technical Data Sheet

Item No. 1.1.3

ACS800-37-0770-3

Specifications		Catalogue data	
Name	500KW Motor		
No.of Inverters	1	Voltage [V]	400
Type	ACS800 low harmonic	Nominal power [kW]	630
Construction	Cabinet	Nominal current [A]	1067
Cooling	Air	Imax [A]	1521
IP Class	IP54R	Ihd [A]	831
Pulse	6-pulse	Pulse	6
		Frame type	2xR8i
		Icont max [A]	1111

Inverter load

Load type	Pump/fan load	
Overload type	Simple cyclic	
Icont [A]	778	540s
Imax [A]	839	60s
cosfii		

Calculations

	Required	Result	Margin
Limit			
Icont [A]	778	1111	N/A
Imax [A]	839	1521	81 %
Pmax kW	494	1093	121 %
Temperature			23 %

Selection method: IGBT temperature

Graph: currents

Drive Technical Data Sheet

Item No. 1.1.4

ACS800-37-0770-3

Specifications		Catalogue data	
Name	550KW Motor		
No.of Inverters	1	Voltage [V]	400
Type	ACS800 low harmonic	Nominal power [kW]	630
Construction	Cabinet	Nominal current [A]	1067
Cooling	Air	Imax [A]	1521
IP Class	IP54R	Ihd [A]	831
Pulse	6-pulse	Pulse	6
		Frame type	2xR8i
		Icont max [A]	1111

Inverter load

Load type	Pump/fan load	
Overload type	Simple cyclic	
Icont [A]	832	540s
Imax [A]	898	60s
cosfii		

Calculations

	Required	Result	Margin
Limit			
Icont [A]	832	1111	N/A
Imax [A]	898	1521	69 %
Pmax kW	542	1093	102 %
Temperature			16 %

Selection method: IGBT temperature

Graph: currents

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Type code: ACS800-37-0510-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 1100 kg (2425 lbs)

C–C

A – A

A – A
TOP VIEW

B – B

B – B
BOTTOM VIEW

Cust. Doc. No.	Prepared 5.6.2014 DD Configurator	Title DIMENSION DRAWING ACS800-37-0510-3		Item des.
Customer	Approved		EDA1	
	Project		Scale (A4) 1:30	Rev.ind. A
ABB Ref. No. Cust Ref. No.		ABB Drives	Doc. No. 3AUA0000047150	Sheet 311
				Cont. 312
				Long.

Type code: ACS800-37-0510-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 1100 kg (2425 lbs)

Drive Unit +01.3
Bottom/Top entry, cables

Drive Unit +11.3
Bottom exit, cable

Cust. Doc. No.	Prepared 5.6.2014 DD Configurator	Title DIMENSION DRAWING ACS800-37-0510-3	EDA1	Item des.
Customer	Approved		Scale (A4) 1:30	Rev.ind. A / Lang.
	Project	ABB Drives	Doc. No. 3AUA0000047150	Sheet 312 / Cont.
ABB Ref. No.	Cust Ref. No.			

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Type code: ACS800-37-0640-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 2500 kg (5512 lbs)

C–C

A – A

A – A
TOP VIEW

B – B

B – B
BOTTOM VIEW

Cust. Doc. No.	Prepared 5.6.2014 DD Configurator	Title DIMENSION DRAWING ACS800-37-0640-3	EDA1	Item des.
Customer	Approved		Scale (A4) 1:30	Rev.ind. A
	Project	ABB Drives	Doc. No. 3AUA0000047151	Lang.
ABB Ref. No. Cust Ref. No.				Sheet 311
				Cont. 312

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Type code: ACS800-37-0640-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 2500 kg (5512 lbs)

Supply Unit +01.2
Bottom entry, cable

Cabling Unit +11.3
Bottom Exit

Cust. Doc. No.	Prepared 5.6.2014	DD Configurator	Title DIMENSION DRAWING ACS800-37-0640-3		Item des.
Customer	Approved			EDA1	
	Project			Scale (A4) 1:30	Rev.ind. A
ABB Ref. No.	Cust Ref. No.		ABB Drives	Doc. No. 3AUA0000047151	Lang.
					Sheet 312
					Cont.

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Type code: ACS800-37-0770-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 2500 kg (5512 lbs)

C–C

A – A

A – A
TOP VIEW

B – B

B – B
BOTTOM VIEW

Cust. Doc. No.	Prepared 5.6.2014 DD Configurator	Title DIMENSION DRAWING ACS800-37-0770-3	EDA1	Item des.
Customer	Approved		Scale (A4) 1:30	Rev.ind. A	Lang.
	Project	ABB Drives	Doc. No. 3AUA0000047151	Sheet 311
ABB Ref. No.	Cust Ref. No.			Cont. 312

Type code: ACS800-37-0770-3
Colour: RAL7035
Dimensions: millimeters (100mm=3.937")
Weight: approx. 2500 kg (5512 lbs)

Supply Unit +01.2
Bottom entry, cable

Cabling Unit +11.3
Bottom Exit

Cust. Doc. No.	Prepared 5.6.2014 DD Configurator	Title DIMENSION DRAWING ACS800-37-0770-3	EDA1	Item des.	
Customer	Approved		Scale (A4) 1:30	Rev.ind. A	Lang.
	Project	ABB Drives	Doc. No. 3AUA0000047151		Sheet 312
ABB Ref. No.	Cust Ref. No.				Cont.

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Type Test Certificate

We hereby declare that the ACS800-17/-37 Frequency converter product series has been subjected to following type tests:

- Insulation test
- Functional test
- Rated current test
- Output voltage test
- Efficiency measurement
- Temperature rise test
- Audible noise test
- Checking of auxiliary devices
- Checking the properties of the control equipment
- Checking the protective devices

The tests were performed in accordance to **IEC 61800-5-1** "Adjustable speed electrical power drive systems –Safety requirements –Electrical, thermal and energy" and applicable UL standard (**UL 508C** "Power Conversion Equipment").
Because of wide power and voltage range of ACS800-17/-37 product series, the tests are done for selected types.

Manufacturer: ABB Oy, Drives
Helsinki, Finland

March 25, 2011

Eero Saarinen
Product Manager

ABB Oy

Postal Address:
Drives
P.O.Box 184
FIN-00381 Helsinki, Finland

Street Address:
Drives
Hiomotie 13
FIN-00380 Helsinki, Finland

Telephone:
+358 10 2211
Telefax:
+358 10 22 xxxxx

Internet:
www.abb.fi
e-mail:
first name.last name
@fi.abb.com

Business Identity Code:
0763403-0
Domicile: Helsinki

FACTORY ACCEPTANCE TEST (FAT) REPORT
ACS800-07/-17/-37

PROJECT INFORMATION	
ABB customer:	
ABB Project name:	
ABB sales ref No:	
EQUIPMENT	
Type:	ACS800-
Serial number:	
TEST AREA SUPPLY NETWORK INFORMATION	
Voltage:	
Frequency:	50Hz
PARTICIPANTS, LOCATION AND DATE	
Inspector's name:	
Sales person's name:	
Test person's name:	
Place of test:	ABB Oy, Drives, Helsinki
Date of test:	

SIGNATURES

On behalf of the customer _____ _____

Block capitals _____ _____

On behalf of ABB Oy, Drives _____ _____

Block capitals _____ _____

The purpose of the FAT is to offer a customer the possibility to review the product and ensure it is according to the order. Standard factory routine testing for the frequency converter is executed before FAT and therefore it is not repeated in the FAT.

Check item	Pass	Failed	Fixed	N. A.
1. VISUAL AND MECHANICAL INSPECTION				
1.1 Dimension drawings inspection	☐	☐	☐	☐
1.2 Label inspection	☐	☐	☐	☐
1.3 General visual inspection	☐	☐	☐	☐
1.4 Components and apparatus inspection	☐	☐	☐	☐
1.5 Wire markings inspection	☐	☐	☐	☐
2 REVIEW OF ROUTINE TEST REPORT				
2.1 Review of routine test results of insulation tests *	☐	☐	☐	☐
2.2 Review of routine test reports of modules	☐	☐	☐	☐
2.3 Review of routine test report of drive	☐	☐	☐	☐
3 REVIEW OF TECHNICAL DOCUMENTATION				
3.1 Review of electrical drawings	☐	☐	☐	☐
3.2 Review of parts list	☐	☐	☐	☐
4 ELECTRICAL AND FUNCTIONAL INSPECTION				
4.1 Functional test of the drive				
4.1.1 Drive information	☐	☐	☐	☐
4.1.2 Test run of the drive without a motor	☐	☐	☐	☐
4.2 Functional test of standard options *(optional)*				
4.2.1 Emergency stop operation	☐	☐	☐	☐
4.2.2 POUS/STO operation	☐	☐	☐	☐
4.2.3 Earth fault monitor (Bender) operation	☐	☐	☐	☐
4.2.4 Customized standard options operation	☐	☐	☐	☐

* Insulation tests are part of factory routine testing.

ATTACHMENTS

Appendix 1: Dielectric and voltage test results

Appendix 2:

Appendix 3:

Appendix 4:

Appendix 5:

REMARKS

1. VISUAL AND MECHANICAL INSPECTION

1.1 Dimension drawings inspection
Ensuring that dimension drawings match the cabinet.

1.2 Label inspection
Ensuring that drive labels match the requirements and customer specification (optional).

1.3 General visual inspection
Ensuring that the cabinet is presentable.

1.4 Components and apparatus inspection
Ensuring that components and apparatus are according to order.

1.5 Wire markings inspection
Ensuring that wire markings are according to the ordered marking class.

2 REVIEW OF ROUTINE TEST REPORT

2.1 Review of routine test results of insulation tests *
Ensuring that insulation and dielectric tests are within limits stated in a test report. Appendix 1

2.2 Review of routine test reports of modules
Ensuring that the drive documentation includes the module test reports.

2.2 Review of routine test report of drive
Ensuring that the drive documentation includes the drive test report and it has traced components

3 REVIEW OF TECHNICAL DOCUMENTATION

3.1 Review of electrical drawings
Ensuring that electrical drawings match the drive.

3.2 Review of parts list
Ensuring that the part list matches the drive apparatus.

4 ELECTRICAL AND FUNCTIONAL INSPECTION

4.1 Functional test of the drive

4.1.1 Drive information

Press the DRIVE button on the control panel and check that the given information matches the drive.

4.1.2 Test run of the drive without a motor

Use control panel CDP312R. Start the drive, run forward at 50Hz frequency, run backwards at 50Hz frequency and stop the drive

4.2 Functional test of standard options *(optional)*

4.2.1 Emergency stop operation

Test emergency stop circuit operation by Starting the drive, then press e-stop button and the drive will stop. Then check that the drive does not start w/o reset

4.2.2 POUS/STO operation

Disconnect short circuit from terminal strip X9:1-X9:2/3. When POUS is operating the drive cannot start after the disconnection. Test the safe torque-off operation.

4.2.3 Earth fault monitor (Bender) operation

Simulate an earth fault to the supply. Earth fault monitor will give a fault indication.

4.2.4 Customized standard options operation

Testing of ABB standard application engineered options like meters, lamps, push buttons and switches.

TEST PROCEDURE OF THE ACS800 FREQUENCY CONVERTER

This document describes the production testing procedure of the ACS800 frequency converter. The testing procedure is divided into two separate sections: testing of the ACS800 frequency converter module and testing of the frequency converter ACS800-X7.

1 TESTING OF THE FREQUENCY CONVERTER MODULE

1.1 INSULATION AND HIGH VOLTAGE TESTS OF THE FREQUENCY CONVERTER MODULE

1.1.1 Insulation resistance test of the main circuit (1000Vdc)
1.1.2 High voltage test of the main circuit(2,7kVac, rms 50Hz 1s)
1.1.3 Slow increase of voltage by DC power supply (50V, 300V, 800V)
- Significance: No short-circuits in the module; discharge resistors intact

1.2 SYSTEM TESTING OF THE FREQUENCY CONVERTER MODULE

1.2.1 Connection of the power supply
- Significance: Charging circuits are intact; electronic boards and cabling intact

1.2.2 Testing of basic functions
- Serial number, software revision, option modules
- Check current measurement and dc voltage measurement at 1500 rpm
- Check stop, start, change of direction commands

1.2.3 Overvoltage fault function
1.2.4 Earth fault protection
1.2.5 Overcurrent fault function
1.2.6 Braking chopper test, if braking chopper does exist
1.2.7 Discharge time of the DC capacitors
- Significance: discharge resistors and dc capacitors are correct

1.3 BURN IN TESTING OF THE FREQUENCY CONVERTER MODULE

1.3.1 The first load test; 15 minutes at 1300-1500 rpm & full load
1.3.2 The first stop sequence
1.3.3 Repeating load tests (3.1 & 3.2) for a total of one and half (1,5) hours
1.3.4 Overvoltage fault function (performed immediately after the last load test before the converter is stopped)
1.3.5 Overcurrent fault function

1.4 FINAL TESTING OF THE FREQUENCY CONVERTER MODULE

1.4.1 Testing of the control panel, if control panel does exist

2 TESTING OF THE FREQUENCY CONVERTER ACS800-07/-17/-37

2.1 VISUAL INSPECTION

2.1.1 Marking and type plates
2.1.2 Markings on power connections
2.1.3 Checking the length of the shaft in the main switch
2.1.4 Checking the earthings
2.1.5 Checking the fixing of mechanical parts and modules
2.1.6 Checking that the components are according to the part list
2.1.7 Cheking the clearances and creepage distances
2.1.7 Cheking the fibre optical cables

2.2 INSULATION AND HIGH VOLTAGE TESTS

2.2.1 Insulation test
2.2.1 High voltage test
2.2.2 Insulation test

2.3 FUNCTIONAL TEST

2.3.1 Checking the auxiliary voltage transformer and time relays settings
2.3.2 Checking the control board and downloading the program
2.3.3 Checking the functional of DSU module, only for ACS800-07
2.3.3 Checking the main contactor operation
2.3.4 Checking the functionality of emergency stop circuitry
2.3.5 Checking PT100 transducers, thermistor relays, heaters and other additional electrical equipment
2.3.6 Checking rotation of fans and auxiliary motor fan supply
2.3.7 Braking chopper test, if braking chopper does exist
2.3.8 Earth fault monitor BENDER test, if BENDER does exist
2.3.9 Control panel test
2.3.10 Setting and testing the option modules
2.3.11 Test run of Drive Unit

2.4 FINAL ACTIONS

2.4.1 Resetting the factory parameters, motor parameters and fault memory
2.4.2 Checking the warning stickers and other labels
2.4.4 Filling the test report

Technical Part
Variable Speed Drive System with ACS1000

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1.3 Performance Data 3
1.4 Converter Cooling 4
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1.6 Converter Enclosure, Dimensions and Weight 5

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6 Technical Data for Positions

100 Variable speed drive system type **ACS1023-W1-S0-00-FJ02**, incl.:

- 24-pulse diode rectifier
- Self-commutated 3-level voltage source inverter with:
  - IGCT power semiconductors, without series or parallel connection of switching devices
  - Fuseless converter design
- Integrated output sine filter
- Water cooled

1.1 Block Diagram

1.2 Main Electrical Converter Data

Nominal driven motor shaft power	700 kW
Maximum continuous output power	778 kVA
Maximum continuous output current	136.1 A
Nominal output voltage ($U_{nominal}$)	3300 V
Supply voltage	4 x 1903 V
Supply voltage tolerance	+ 10 / -10%
Nominal output power down to	90% supply voltage
Safe operation down to	75% supply voltage, with reduced power
Maximum supply phase unbalance	2%
Supply frequency	50 Hz
Supply frequency tolerance	± 2%
Total input power factor	> 0.95 (for 20 ... 100% load)

1.3 Performance Data

Output voltage range	0... $U_{nominal}$
Output frequency control range	0... ± 66 Hz (optionally up to 82.5 Hz)
Short term overloadability	110% (60 sec. every 600 sec.)
Accuracy of speed control	typically 0.1% of nominal speed
Torque rise time	< 10 ms
Minimum nominal base frequency	45 Hz (lower settings possible with power derating)
Maximum field weakening range	1 : 1.5
Total drive efficiency at nominal load	> 97.9% (including auxiliaries and output sine filter → no additional motor losses from harmonic heating to be expected)
Output harmonic distortion	typically < 2% for voltage and current (at nominal load conditions)
Torque ripple	typically < 2% of nominal torque (for all frequency components; no particular PWM carrier component existent due to DTC)

Design comments/warnings:

1) Based on IEC 60076-5 standard, the minimum short-circuit voltage of the transformer should be 5%

2) Too high voltage drop over supply network/transformer impedance (0.116)! Increase Ssc_min and/or decrease transformer impedance!

3) Special transformer protection required due to low primary-side s.c. current. Isc = 2.47pu

1.4 Converter Cooling

Cooling method	Water cooling with integrated cooling pumps, water / water heat exchanger and instrumentation for supervision
Nominal heat losses	14.5 kW
Maximum heat losses	17.9 kW
Heat dissipation to electrical room	< 1 kW typically
Nominal raw water flow	90 l/min
Maximal raw water flow	160 l/min
Raw water inlet pressure range	70 – 1000 kPa (ideal 300 – 600 kPa)
Nominal pressure drop	70 kPa
Maximum pressure drop	220 kPa
Raw water inlet temperature range	4 – 27 °C
Redundant cooling pumps	yes
Redundant cooling auxiliary fan	yes

1.5 Additional Data

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Auxiliary power consumption	approx. 4.3 kW (without optional heaters/coolers)
Control power supply voltage	Internally derived, backed-up by internal back-up batteries
Sound pressure level	< 70 dB (A) under nominal conditions

1.6 Converter Enclosure, Dimensions and Weight

Type of enclosure	Corrosion protected, coated steel enclosure, EMC conforming, 2mm (12 gauge) thick sheet steel
Painting of enclosure	All external cabinet surfaces painted in RAL 7035
Door interlocking	Electromechanical door interlocking system for personnel safety
Degree of protection	IP 54
Cable entry	Top or bottom
Accessibility for maintenance	Only front access required
Dimensions (width * depth * height)	5044 * 902 * 2002 mm

Weight	3650 kg (approx. value)

2 Standards and Certifications

The ACS 1000 complies with following codes and standards:

Drive Standards	IEC 60146-1-1 IEC 61800-4 GOST-R
Impulse test voltage	60 kV, 1.2 / 50 µs (on secondary side of input isolation transformer)
AC test voltage	20 kV, 1 min (on secondary side of input isolation transformer)
Network harmonics	Compliance with IEEE 519, IEC 61000-2-4 at both, supply side and motor side

Following certifications are available for ACS 1000:

Certifications	CE compliance Marine certifications on request GOST-R certification

3 Plant Design Data

3.1 Ambient Conditions

Altitude of installation	≤ 1000 m a.s.l.
Installation of drive	indoors
Ambient operating temp. range	1 ... 50 °C (non freezing)
Transportation and storage temp.	1 ... + 55 °C
Relative humidity	≤ 95 %, non condensing
Expected transformer cable length	≤ 5 m (between transformer and drive)
Expected motor cable length	≤ 5000 m
Area classification of motor	non hazardous

3.2 Supply Network

Voltage	11000 V
Supply voltage tolerance	+ 10 / -10%
Min. Supply Voltage, at which the drive has to deliver full power	90 %
Supply frequency	50 Hz
Supply frequency tolerance	± 3%
Maximum supply phase unbalance	2%
Short circuit power	min. 200 MVA max. 350 MVA

3.3 Auxiliary supply

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Control power supply voltage	Internally derived from customer's 3-phase supply, backed-up by internal back-up batteries
Control supply voltage tolerance	± 10%

3.4 Load Information for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Load characteristic	square torque	
Nominal speed	1000	rpm
Required power at nominal speed	700	kW
Starting torque	30	%
Required overload	210	%
	for 6 sec. / 10 min.	
Maximum speed	1000	rpm

3.5 Motor Data for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Motor voltage	3300	V
Motor nominal frequency	50	Hz
Motor pole number	6	
Motor nominal shaft power	700	kW
Efficiency at nominal load	97.1	%
Power factor at nominal load	0.9	pu
Breakdown torque	2.2	pu

3.6 Drive Monitor

DriveMonitor variant Without DriveMonitor

Technical Part
Variable Speed Drive System with ACS1000

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6 Technical Data for Positions

100 Variable speed drive system type **ACS1023-W1-S0-00-FJ02**, incl.:

- 24-pulse diode rectifier
- Self-commutated 3-level voltage source inverter with:
  - IGCT power semiconductors, without series or parallel connection of switching devices
  - Fuseless converter design
- Integrated output sine filter
- Water cooled

1.1 Block Diagram

1.2 Main Electrical Converter Data

Nominal driven motor shaft power	1050 kW
Maximum continuous output power	1247 kVA
Maximum continuous output current	218.2 A
Nominal output voltage ($U_{nominal}$)	3300 V
Supply voltage	4 x 1903 V
Supply voltage tolerance	+ 10 / -10%
Nominal output power down to	90% supply voltage
Safe operation down to	75% supply voltage, with reduced power
Maximum supply phase unbalance	2%
Supply frequency	50 Hz
Supply frequency tolerance	± 2%
Total input power factor	> 0.95 (for 20 ... 100% load)

1.3 Performance Data

Output voltage range	0... $U_{nominal}$
Output frequency control range	0... ± 66 Hz (optionally up to 82.5 Hz)
Short term overloadability	110% (60 sec. every 600 sec.)
Accuracy of speed control	typically 0.1% of nominal speed
Torque rise time	< 10 ms
Minimum nominal base frequency	45 Hz (lower settings possible with power derating)
Maximum field weakening range	1 : 1.5
Total drive efficiency at nominal load	> 98.3% (including auxiliaries and output sine filter → no additional motor losses from harmonic heating to be expected)
Output harmonic distortion	typically < 2% for voltage and current (at nominal load conditions)
Torque ripple	typically < 2% of nominal torque (for all frequency components; no particular PWM carrier component existent due to DTC)

1.4 Converter Cooling

Cooling method	Water cooling with integrated cooling pumps, water / water heat exchanger and instrumentation for supervision
Nominal heat losses	18.7 kW
Maximum heat losses	21.7 kW
Heat dissipation to electrical room	< 1 kW typically
Nominal raw water flow	90 l/min
Maximal raw water flow	160 l/min
Raw water inlet pressure range	70 – 1000 kPa (ideal 300 – 600 kPa)
Nominal pressure drop	70 kPa
Maximum pressure drop	220 kPa
Raw water inlet temperature range	4 – 27 °C
Redundant cooling pumps	yes
Redundant cooling auxiliary fan	yes

1.5 Additional Data

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Auxiliary power consumption	approx. 4.3 kW (without optional heaters/coolers)
Control power supply voltage	Internally derived, backed-up by internal back-up batteries
Sound pressure level	< 70 dB (A) under nominal conditions

1.6 Converter Enclosure, Dimensions and Weight

Type of enclosure	Corrosion protected, coated steel enclosure, EMC conforming, 2mm (12 gauge) thick sheet steel
Painting of enclosure	All external cabinet surfaces painted in RAL 7035
Door interlocking	Electromechanical door interlocking system for personnel safety
Degree of protection	IP 54
Cable entry	Top or bottom
Accessibility for maintenance	Only front access required
Dimensions (width * depth * height)	5044 * 902 * 2002 mm

Weight	3650 kg (approx. value)

2 Standards and Certifications

The ACS 1000 complies with following codes and standards:

Drive Standards	IEC 60146-1-1 IEC 61800-4 GOST-R
Impulse test voltage	60 kV, 1.2 / 50 µs (on secondary side of input isolation transformer)
AC test voltage	20 kV, 1 min (on secondary side of input isolation transformer)
Network harmonics	Compliance with IEEE 519, IEC 61000-2-4 at both, supply side and motor side

Following certifications are available for ACS 1000:

Certifications	CE compliance Marine certifications on request GOST-R certification

3 Plant Design Data

3.1 Ambient Conditions

Altitude of installation	≤ 1000 m a.s.l.
Installation of drive	indoors
Ambient operating temp. range	1 ... 50 °C (non freezing)
Transportation and storage temp.	1 ... + 55 °C
Relative humidity	≤ 95 %, non condensing
Expected transformer cable length	≤ 100 m (between transformer and drive)
Expected motor cable length	≤ 5000 m
Area classification of motor	non hazardous

3.2 Supply Network

Voltage	11000 V
Supply voltage tolerance	+ 10 / -10%
Min. Supply Voltage, at which the drive has to deliver full power	90 %
Supply frequency	50 Hz
Supply frequency tolerance	± 3%
Maximum supply phase unbalance	2%
Short circuit power	min. 200 MVA max. 350 MVA

3.3 Auxiliary supply

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Control power supply voltage	Internally derived from customer's 3-phase supply, backed-up by internal back-up batteries
Control supply voltage tolerance	± 10%

3.4 Load Information for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Load characteristic	square torque	
Nominal speed	1000	rpm
Required power at nominal speed	1050	kW
Starting torque	30	%
Required overload	145	%
	for 60 sec. / 10 min.	
Maximum speed	1000	rpm

3.5 Motor Data for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Motor voltage	3300	V
Motor nominal frequency	50	Hz
Motor pole number	6	
Motor nominal shaft power	1050	kW
Efficiency at nominal load	97.1	%
Power factor at nominal load	0.867	pu
Breakdown torque	2.2	pu

3.6 Drive Monitor

DriveMonitor variant Without DriveMonitor

Technical Part
Variable Speed Drive System with ACS1000

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6 Technical Data for Positions

100 Variable speed drive system type **ACS1023-W1-S0-00-FJ02**, incl.:

- 24-pulse diode rectifier
- Self-commutated 3-level voltage source inverter with:
  - IGCT power semiconductors, without series or parallel connection of switching devices
  - Fuseless converter design
- Integrated output sine filter
- Water cooled

1.1 Block Diagram

1.2 Main Electrical Converter Data

Nominal driven motor shaft power	1200 kW
Maximum continuous output power	1373 kVA
Maximum continuous output current	240.2 A
Nominal output voltage ($U_{nominal}$)	3300 V
Supply voltage	4 x 1903 V
Supply voltage tolerance	+ 10 / -10%
Nominal output power down to	90% supply voltage
Safe operation down to	75% supply voltage, with reduced power
Maximum supply phase unbalance	2%
Supply frequency	50 Hz
Supply frequency tolerance	± 2%
Total input power factor	> 0.95 (for 20 ... 100% load)

1.3 Performance Data

Output voltage range	0... $U_{nominal}$
Output frequency control range	0... ± 66 Hz (optionally up to 82.5 Hz)
Short term overloadability	110% (60 sec. every 600 sec.)
Accuracy of speed control	typically 0.1% of nominal speed
Torque rise time	< 10 ms
Minimum nominal base frequency	45 Hz (lower settings possible with power derating)
Maximum field weakening range	1 : 1.5
Total drive efficiency at nominal load	> 98.3% (including auxiliaries and output sine filter → no additional motor losses from harmonic heating to be expected)
Output harmonic distortion	typically < 2% for voltage and current (at nominal load conditions)
Torque ripple	typically < 2% of nominal torque (for all frequency components; no particular PWM carrier component existent due to DTC)

1.4 Converter Cooling

Cooling method	Water cooling with integrated cooling pumps, water / water heat exchanger and instrumentation for supervision
Nominal heat losses	20.6 kW
Maximum heat losses	23.5 kW
Heat dissipation to electrical room	< 1 kW typically
Nominal raw water flow	90 l/min
Maximal raw water flow	160 l/min
Raw water inlet pressure range	70 – 1000 kPa (ideal 300 – 600 kPa)
Nominal pressure drop	70 kPa
Maximum pressure drop	220 kPa
Raw water inlet temperature range	4 – 27 °C
Redundant cooling pumps	yes
Redundant cooling auxiliary fan	yes

1.5 Additional Data

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Auxiliary power consumption	approx. 4.3 kW (without optional heaters/coolers)
Control power supply voltage	Internally derived, backed-up by internal back-up batteries
Sound pressure level	< 70 dB (A) under nominal conditions

1.6 Converter Enclosure, Dimensions and Weight

Type of enclosure	Corrosion protected, coated steel enclosure, EMC conforming, 2mm (12 gauge) thick sheet steel
Painting of enclosure	All external cabinet surfaces painted in RAL 7035
Door interlocking	Electromechanical door interlocking system for personnel safety
Degree of protection	IP 54
Cable entry	Top or bottom
Accessibility for maintenance	Only front access required
Dimensions (width * depth * height)	5044 * 902 * 2002 mm

Weight	3650 kg (approx. value)

2 Standards and Certifications

The ACS 1000 complies with following codes and standards:

Drive Standards	IEC 60146-1-1 IEC 61800-4 GOST-R
Impulse test voltage	60 kV, 1.2 / 50 µs (on secondary side of input isolation transformer)
AC test voltage	20 kV, 1 min (on secondary side of input isolation transformer)
Network harmonics	Compliance with IEEE 519, IEC 61000-2-4 at both, supply side and motor side

Following certifications are available for ACS 1000:

Certifications	CE compliance Marine certifications on request GOST-R certification

3 Plant Design Data

3.1 Ambient Conditions

Altitude of installation	≤ 1000 m a.s.l.
Installation of drive	indoors
Ambient operating temp. range	1 ... 50 °C (non freezing)
Transportation and storage temp.	1 ... + 55 °C
Relative humidity	≤ 95 %, non condensing
Expected transformer cable length	≤ 100 m (between transformer and drive)
Expected motor cable length	≤ 5000 m
Area classification of motor	non hazardous

3.2 Supply Network

Voltage	11000 V
Supply voltage tolerance	+ 10 / -10%
Min. Supply Voltage, at which the drive has to deliver full power	90 %
Supply frequency	50 Hz
Supply frequency tolerance	± 3%
Maximum supply phase unbalance	2%
Short circuit power	min. 200 MVA max. 350 MVA

3.3 Auxiliary supply

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Control power supply voltage	Internally derived from customer's 3-phase supply, backed-up by internal back-up batteries
Control supply voltage tolerance	± 10%

3.4 Load Information for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Load characteristic	square torque	
Nominal speed	1000	rpm
Required power at nominal speed	1200	kW
Starting torque	30	%
Required overload	130	%
	for 60 sec. / 10 min.	
Maximum speed	1000	rpm

3.5 Motor Data for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Motor voltage	3300	V
Motor nominal frequency	50	Hz
Motor pole number	6	
Motor nominal shaft power	1200	kW
Efficiency at nominal load	97.1	%
Power factor at nominal load	0.9	pu
Breakdown torque	2.2	pu

3.6 Drive Monitor

DriveMonitor variant Without DriveMonitor

Technical Part
Variable Speed Drive System with ACS1000

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6 Technical Data for Positions

100 Variable speed drive system type **ACS1023-W1-S0-00-FJ02**, incl.:

- 24-pulse diode rectifier
- Self-commutated 3-level voltage source inverter with:
  - IGCT power semiconductors, without series or parallel connection of switching devices
  - Fuseless converter design
- Integrated output sine filter
- Water cooled

1.1 Block Diagram

1.2 Main Electrical Converter Data

Nominal driven motor shaft power	1400 kW
Maximum continuous output power	1602 kVA
Maximum continuous output current	280.3 A
Nominal output voltage ($U_{nominal}$)	3300 V
Supply voltage	4 x 1903 V
Supply voltage tolerance	+ 10 / -10%
Nominal output power down to	90% supply voltage
Safe operation down to	75% supply voltage, with reduced power
Maximum supply phase unbalance	2%
Supply frequency	50 Hz
Supply frequency tolerance	± 2%
Total input power factor	> 0.95 (for 20 ... 100% load)

1.3 Performance Data

Output voltage range	0... $U_{nominal}$
Output frequency control range	0... ± 66 Hz (optionally up to 82.5 Hz)
Short term overloadability	110% (60 sec. every 600 sec.)
Accuracy of speed control	typically 0.1% of nominal speed
Torque rise time	< 10 ms
Minimum nominal base frequency	45 Hz (lower settings possible with power derating)
Maximum field weakening range	1 : 1.5
Total drive efficiency at nominal load	> 98.4% (including auxiliaries and output sine filter → no additional motor losses from harmonic heating to be expected)
Output harmonic distortion	typically < 2% for voltage and current (at nominal load conditions)
Torque ripple	typically < 2% of nominal torque (for all frequency components; no particular PWM carrier component existent due to DTC)

1.4 Converter Cooling

Cooling method	Water cooling with integrated cooling pumps, water / water heat exchanger and instrumentation for supervision
Nominal heat losses	23.4 kW
Maximum heat losses	26.2 kW
Heat dissipation to electrical room	< 1 kW typically
Nominal raw water flow	90 l/min
Maximal raw water flow	160 l/min
Raw water inlet pressure range	70 – 1000 kPa (ideal 300 – 600 kPa)
Nominal pressure drop	70 kPa
Maximum pressure drop	220 kPa
Raw water inlet temperature range	4 – 27 °C
Redundant cooling pumps	yes
Redundant cooling auxiliary fan	yes

1.5 Additional Data

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Auxiliary power consumption	approx. 4.3 kW (without optional heaters/coolers)
Control power supply voltage	Internally derived, backed-up by internal back-up batteries
Sound pressure level	< 70 dB (A) under nominal conditions

1.6 Converter Enclosure, Dimensions and Weight

Type of enclosure	Corrosion protected, coated steel enclosure, EMC conforming, 2mm (12 gauge) thick sheet steel
Painting of enclosure	All external cabinet surfaces painted in RAL 7035
Door interlocking	Electromechanical door interlocking system for personnel safety
Degree of protection	IP 54
Cable entry	Top or bottom
Accessibility for maintenance	Only front access required
Dimensions (width * depth * height)	5044 * 902 * 2002 mm

Weight	3650 kg (approx. value)

2 Standards and Certifications

The ACS 1000 complies with following codes and standards:

Drive Standards	IEC 60146-1-1 IEC 61800-4 GOST-R
Impulse test voltage	60 kV, 1.2 / 50 μs (on secondary side of input isolation transformer)
AC test voltage	20 kV, 1 min (on secondary side of input isolation transformer)
Network harmonics	Compliance with IEEE 519, IEC 61000-2-4 at both, supply side and motor side

Following certifications are available for ACS 1000:

Certifications	CE compliance Marine certifications on request GOST-R certification

3 Plant Design Data

3.1 Ambient Conditions

Altitude of installation	≤ 1000 m a.s.l.
Installation of drive	indoors
Ambient operating temp. range	1 ... 50 °C (non freezing)
Transportation and storage temp.	1 ... + 55 °C
Relative humidity	≤ 95 %, non condensing
Expected transformer cable length	≤ 100 m (between transformer and drive)
Expected motor cable length	≤ 5000 m
Area classification of motor	non hazardous

3.2 Supply Network

Voltage	11000 V
Supply voltage tolerance	+ 10 / -10%
Min. Supply Voltage, at which the drive has to deliver full power	90 %
Supply frequency	50 Hz
Supply frequency tolerance	± 3%
Maximum supply phase unbalance	2%
Short circuit power	min. 200 MVA max. 350 MVA

3.3 Auxiliary supply

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Control power supply voltage	Internally derived from customer's 3-phase supply, backed-up by internal back-up batteries
Control supply voltage tolerance	± 10%

3.4 Load Information for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Load characteristic	square torque	
Nominal speed	1000	rpm
Required power at nominal speed	1400	kW
Starting torque	30	%
Required overload	110	%
for	60 sec. / 10 min.	
Maximum speed	1000	rpm

3.5 Motor Data for Positions

100 ACS1023-W1-S0-00-FJ02

Application		
Motor voltage	3300	V
Motor nominal frequency	50	Hz
Motor pole number	6	
Motor nominal shaft power	1400	kW
Efficiency at nominal load	97.1	%
Power factor at nominal load	0.9	pu
Breakdown torque	2.2	pu

3.6 Drive Monitor

DriveMonitor variant Without DriveMonitor

Technical Part
Variable Speed Drive System with ACS1000

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6 Technical Data for Positions

100 Variable speed drive system type **ACS1023-W1-U0-00-FJ11**, incl.:

- 24-pulse diode rectifier
- Self-commutated 3-level voltage source inverter with:
  - IGCT power semiconductors, without series or parallel connection of switching devices
  - Fuseless converter design
- Integrated output sine filter
- Water cooled

1.1 Block Diagram

1.2 Main Electrical Converter Data

Nominal driven motor shaft power	2200 kW
Maximum continuous output power	2613 kVA
Maximum continuous output current	457.2 A
Nominal output voltage ($U_{nominal}$)	3300 V
Supply voltage	4 x 1903 V
Supply voltage tolerance	+ 10 / -10%
Nominal output power down to	90% supply voltage
Safe operation down to	75% supply voltage, with reduced power
Maximum supply phase unbalance	2%
Supply frequency	50 Hz
Supply frequency tolerance	± 2%
Total input power factor	> 0.95 (for 20 ... 100% load)

1.3 Performance Data

Output voltage range	0... $U_{nominal}$
Output frequency control range	0... ± 66 Hz (optionally up to 82.5 Hz)
Short term overloadability	110% (6 sec. every 60 sec.)
Accuracy of speed control	typically 0.1% of nominal speed
Torque rise time	< 10 ms
Minimum nominal base frequency	45 Hz (lower settings possible with power derating)
Maximum field weakening range	1 : 1.5
Total drive efficiency at nominal load	> 98.3% (including auxiliaries and output sine filter → no additional motor losses from harmonic heating to be expected)
Output harmonic distortion	typically < 2% for voltage and current (at nominal load conditions)
Torque ripple	typically < 2% of nominal torque (for all frequency components; no particular PWM carrier component existent due to DTC)

Design comments/warnings:

1) Based on IEC 60076-5 standard, the minimum short-circuit voltage of the transformer should be 7%

2) Special transformer protection required due to low primary-side s.c. current. Isc = 3.95pu

1.4 Converter Cooling

Cooling method	Water cooling with integrated cooling pumps, water / water heat exchanger and instrumentation for supervision
Nominal heat losses	36.9 kW
Maximum heat losses	41.8 kW
Heat dissipation to electrical room	< 1 kW typically
Nominal raw water flow	90 l/min
Maximal raw water flow	160 l/min
Raw water inlet pressure range	70 – 1000 kPa (ideal 300 – 600 kPa)
Nominal pressure drop	70 kPa
Maximum pressure drop	220 kPa
Raw water inlet temperature range	4 – 27 °C
Redundant cooling pumps	yes
Redundant cooling auxiliary fan	yes

1.5 Additional Data

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Auxiliary power consumption	approx. 4.3 kW (without optional heaters/coolers)
Control power supply voltage	Internally derived, backed-up by internal back-up batteries
Sound pressure level	< 70 dB (A) under nominal conditions

1.6 Converter Enclosure, Dimensions and Weight

Type of enclosure	Corrosion protected, coated steel enclosure, EMC conforming, 2mm (12 gauge) thick sheet steel
Painting of enclosure	All external cabinet surfaces painted in RAL 7035
Door interlocking	Electromechanical door interlocking system for personnel safety
Degree of protection	IP 54
Cable entry	Top or bottom
Accessibility for maintenance	Only front access required
Dimensions (width * depth * height)	5044 * 902 * 2002 mm

Weight	3650 kg (approx. value)

2 Standards and Certifications

The ACS 1000 complies with following codes and standards:

Drive Standards	IEC 60146-1-1 IEC 61800-4 GOST-R
Impulse test voltage	60 kV, 1.2 / 50 µs (on secondary side of input isolation transformer)
AC test voltage	20 kV, 1 min (on secondary side of input isolation transformer)
Network harmonics	Compliance with IEEE 519, IEC 61000-2-4 at both, supply side and motor side

Following certifications are available for ACS 1000:

Certifications	CE compliance Marine certifications on request GOST-R certification

3 Plant Design Data

3.1 Ambient Conditions

Altitude of installation	≤ 1000 m a.s.l.
Installation of drive	indoors
Ambient operating temp. range	1 ... 50 °C (non freezing)
Transportation and storage temp.	1 ... + 55 °C
Relative humidity	≤ 95 %, non condensing
Expected transformer cable length	≤ 100 m (between transformer and drive)
Expected motor cable length	≤ 5000 m
Area classification of motor	non hazardous

3.2 Supply Network

Voltage	11000 V
Supply voltage tolerance	+ 10 / -10%
Min. Supply Voltage, at which the drive has to deliver full power	90 %
Supply frequency	50 Hz
Supply frequency tolerance	± 3%
Maximum supply phase unbalance	2%
Short circuit power	min. 200 MVA max. 350 MVA

3.3 Auxiliary supply

Auxiliary supply voltage	400 VAC, 3-phase, 50 Hz
Auxiliary supply voltage tolerance	± 10%
Control power supply voltage	Internally derived from customer's 3-phase supply, backed-up by internal back-up batteries
Control supply voltage tolerance	± 10%

3.4 Load Information for Positions

100 ACS1023-W1-U0-00-FJ11

Application		
Load characteristic	square torque	
Nominal speed	1000	rpm
Required power at nominal speed	2200	kW
Starting torque	30	%
Required overload	120	%
	for 6 sec. / 10 min.	
Maximum speed	1000	rpm

3.5 Motor Data for Positions

100 ACS1023-W1-U0-00-FJ11

Application		
Motor voltage	3300	V
Motor nominal frequency	50	Hz
Motor pole number	6	
Motor nominal shaft power	2200	kW
Efficiency at nominal load	97.1	%
Power factor at nominal load	0.867	pu
Breakdown torque	2.2	pu

3.6 Drive Monitor

DriveMonitor variant Without DriveMonitor

Type Test Certificate

We hereby declare that the family of MV Drive products, listed below has been subjected to following type tests:

- Insulation test
- Light load and functional test
- Rated current test
- Power loss determination for assemblies and equipment
- Temperature rise test
- Checking of auxiliary devices
- Checking the properties of the control equipment
- Checking the protective devices

The tests were performed in accordance to **IEC 60146-1-1** "Semiconductor converters" and applicable UL standards (**UL 347** "High Voltage Industrial Control Equipment" and **UL 508C** "Power Conversion Equipment").

Manufacturer:	ABB Switzerland AG CH 5300 Turgi
Product name:	ACS 1000 Medium Voltage Drive water cooled, rated for 3.3kV and 4kV output voltage
Type designation:	ACS10xy-Wz, followed by suffixes, whereby x, y, z stands for:

x =	1	12-pulse diode rectifier
	2	24-pulse diode rectifier
y =	3	3.3kV output voltage
	4	4 kV output voltage
Wz =	W1	frame size W1
	W2	frame size W2
	W3	frame size W3

Date: July 18, 2005

Dr. Gerald Scheuer
Director, Product Management

Jochen Rees
Product Coordinator, ACS1000

ABB Switzerland Ltd

Postal Address
ABB Switzerland Ltd
Medium Voltage AC Drives
Austrasse
CH-5300 Turgi/Switzerland

Phone
+41 (0) 58 589 27 95

Fax
+41 (0) 58 589 29 84

Web address
Internet:
www.abb.com/motors&drives
e-Mail:
mvdrives@ch.abb.com

Bank details
Credit Suisse
Account No: 0835-201309
CH-8070 Zürich/Switzerland
Netting Code: CHIND

Notes:
Recommended distances to the walls: recommended (minimal)
Front side: >1000mm
Rear side: >100mm (0mm)
Left side: >100mm (0mm)
Right side: >100mm (0mm) / >300mm if flange connection, see additional sheet
Top side: >100mm / >700mm if redundant fan is installed

Weight (approx. value)
Converter Unit (ACS 1000W): 3000 - 3500kg (depending on version)
redundant Fan: 75kg

Redundant fan is removed for transportation (delivered separately)

For indoor installation only

A–A

Standard general tolerance of dimensions:

dimension:	variation:
0 - 500mm	+/- 1%
500 - 2000mm	+/- 0.5%
> 2000mm	+/- 0.25%

Dimensions: mm

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Prepared: S.Kehl-Rheinegger 2011-09-25	Based on:	Sep. PL same no: ☐ anoth. no: ☐	Scale: 1:40
Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls	Doc-Type: ZAB
Approved: J.Rees 2011-09-25	Take over dep:		Format: A3
Revision: B) 51784 11.12.2013 E. Goekatli			Language: en
ABB Schweiz AG		3BHS360757_E01	No.of sh: 6
			Sheet no: 1

Cable entry from top

top view:

Cable entry from bottom

bottom view:

power cables:

control cables:

Dimensions: mm

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Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls Cable entry EMC plates			
Approved: J.Rees 2011-09-25	Take over dep:				Language: en
Revision: BI 51784 11.12.2013 E. Goekatli					No.of sh: 6
ABB Schweiz AG		3BHS360757_E01			Sheet no: 2

Cable entry from top

top view:

Cable entry from bottom

bottom view:

power cables:

control cables:

Dimensions: mm

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Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls Cable entry undrilled plate			
Approved: J.Rees 2011-09-25	Take over dep:				Language: en
Revision: 81 51784 11.12.2013 E. Goekatli					No.of sh: 6
ABB Schweiz AG		3BHS360757_E01			Sheet no: 3

Cable entry from top

Cable entry from bottom

power cables:

top view:

bottom view:

control cables:

Dimensions: mm

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Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls Cable entry frame			
Approved: J.Rees 2011-09-25	Take over dep:				Language: en
Revision: BI 51784 11.12.2013 E. Goekalli					No.of sh: 6
ABB Schweiz AG		3BHS360757_E01			Sheet no: 4

Dimensions: mm

Prepared: S.Kehl-Rheinegger 2011-09-25	Based on:	Sep. PL same no: ☐ anoth. no: ☐	Scale: 120	Doc-type: ZAB	Format: A3
Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls Terminal area			
Approved: J.Rees 2011-09-25	Take over dep:				Language: en
Revision: B) 51784 11.12.2013 E. Goekatli					No.of sh: 6
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Optional: Flange connections

Bottom connection

Top connection

Drain connection

Air-Water HEX supply

Side connection

Rear connection

Metal hose connection

Flange detail 2"

1:10

Flange detail 1"

1:10

Nozzle No.	Description	Size
N1	Cooling water outlet	2"(150lbs) / DN50 (PN16)
N2	Cooling water inlet	2"(150lbs) / DN50 (PN16)
N3	Drain	2"(150lbs) / DN50 (PN16)
N4	Auxiliary cooling water outlet	1"(150lbs) / B16.5
N5	Auxiliary cooling water inlet	1"(150lbs) / B16.5

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Prepared: S.Kehl-Rheinegger 2011-09-25	Based on:	Sep. PL same no: ☐ anoth. no: ☐	Scale: 1:40	Doc-type: ZAB	Format: A3
Reviewed: J.Rees 2011-09-25	Resp. dep: ATD1	Outline Drawing ACS 1000W1 24-Puls Flange connections			
Approved: J.Rees 2011-09-25	Take over dep:				Language: en
Revision: BI 51784 11.12.2013 E. Goekalli					No.of sh: 6
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INSPECTION AND TEST PLAN (ITP)

Product: **Medium Voltage Drives**

ACS 1000

Project: **<Plant / Customer>**

External Order Number: **<Number>**

ABB Order Number **<Number>**

Performed QA-Standard: ISO 9001 : 2008

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1. Definitions

Hold points
A 'hold' point defines a point beyond which the work does not proceed without the authorization of the instance requesting the hold point. The instance's presence is mandatory unless waived in writing.
H = Hold point

Witness points
A 'witness' point provides a party (such as the customer or its deputy) with the opportunity to witness the inspection, the test or a certain aspect of the work. In any case, the work will proceed as planned.
W = Witness point

Self inspection
The task responsible verifies the quality with the aid of checklists.
S = Self Inspection

ABB CHIND
Local product group MV Drives Turgi, Switzerland.

2. Inspection by customer

Entry of witness and hold points of the customer
All required witness and hold points have to be entered into the ITP in the column "Inspection by customer" according to contract.

Notification of readiness for inspection
The project manager has to notify the customer or his authorized deputy of the date of all witness and hold points specified by the customer in the ITP.

If no special arrangement has been made concerning the time of notification, the following provision will hold good:
– Notification of readiness at least 10 working days in advance
– Confirmation of definitive performance at least 3 working days in advance

Conducting an inspection
If a hold point of the customer is defined, the customer's or his authorized deputy's presence is mandatory. Waiting times beyond the notified date of readiness are at the expense of the customer including any impact on contractual delivery dates. In case of witness points, the inspection will not be postponed if the witnessing party is not present.

Cancellation of the inspection by the customer
If the inspection is cancelled by the customer or his authorized deputy, the responsible project manager within ABB has to be notified in writing.

Inspection and acceptance confirmation
After the inspection has been performed successfully, the inspector of the customer confirms his inspection in the column "Signature inspection" of the ITP or on the verifying document.

3. Verifying documents for the customer

Verifying documents should only be submitted to the customer by the responsible project manager. The customer receives the verifying documents marked with (R) by default (unless it has been agreed not to conduct the respective test). Other documents may be provided on request. Documents marked with (I) are internal documents - in many cases not in English language - which are not submitted to the customer but can be shown during the factory acceptance test upon customer request.

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Standard QA process

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INSPECTION AND TEST PLAN (ITP)

Legend:
(See definitions in chapter 1 & 3)

H = Hold point
W = Witness point
S = Self inspection
(R) = For customer by default
(I) = Internal document

Task No.	Task description	Ref. document / Acceptance criteria	Verifying documents	Inspection by			Signature / Inspection / Remarks
				SUPPLIER	ABB CHIND	CUSTOMER	
1.0	**Contract review**	Contract	Order acknowledgement (R)		H		
2.0	**Engineering design** **Only for specific orders**	Engineering according order	Engineering design documents (R)		H		
3.0	**Supplier component tests**						
3.1	**Power capacitors**	Component specification (I)	Supplier's test report (I)	H			
3.2	**Filter chokes**	Component specification (I)	Supplier's test report (I)	H			
3.3	**Input transformer**	Component specification (I)	Supplier's test report (I)	H			
3.4	**Water cooling unit (WCU)** (if applicable)	Component specification (I)	Supplier's test report (I)	H			
4.0	**Inspection of incoming goods**	Incoming inspection (I) 3BHS196239 ZAB D01	Signed delivery receipt (I)		S		
5.0	**Test during and after assembly**	Inspection checklist (I) Water: 3BHS901088 ZAB D01 Air: 3BHS901078 ZAB D01	Signed inspection checklist (I)		S		

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INSPECTION AND TEST PLAN (ITP)

Legend:
(See definitions in chapter 1 & 3)

H = Hold point
W = Witness point
S = Self inspection
(R) = For customer by default
(I) = Internal document

Task No.	Task description	Ref. document / Acceptance criteria	Verifying documents	Inspection by: SUPPLIER	Inspection by: ABB CHIND	Inspection by: CUSTOMER	Signature / Inspection / Remarks
6.0	**Routine test:** *)	Routine test and factory acceptance test description (R) 3BHS346110 ZAB E01 Test instruction 3BHS357063 ZAB D01	Routine test report (R)		H		
	1 Visual Inspection						
	2 Hydraulic and pressure test						
	3 Insulation test						
	4 Auxiliaries and control						
	4.1 Checking of auxiliary devices						
	4.2 Checking the properties of the control equipment						
	4.3 Checking the protective devices						
	5 Functional test						
	5.1 Rated current test						
	5.2 Light load and functional test						
7.0	**Factory acceptance test (FAT)** Only if required by customer	Routine test and factory acceptance test description (R) 3BHS346110 ZAB E01	FAT report (R)			W	
8.0	**Delivery inspection**						
8.1	**Shipping**	Completeness check (document generated during packing process)	Packing list (R)		H		
8.2	**On site test** **Only if part of contract**	Test and commissioning specification (I) 3BHS210669 ZAB E01	Commissioning report (R)		H		

*) The numbers of the routine test steps correlate to the "Routine test and factory acceptance test description" (3BHS346110 ZAB E01).

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4. Revision 3BHS------ ZAB E---

Rev. index	Page (P) Chapt.(C)	Description	Date Name / Dept.
-			yyyy-mm-dd F. Surname / ----

Product brochure

Medium voltage AC drive
ACS 1000, ACS 1000i
315 kW – 5 MW, 2.3 – 4.16 kV

Power and productivity
for a better world™

ACS 1000, ACS 1000i – reliable power control

The ACS 1000 family of drives, one of the most successful variable speed drives in its class, provides simple and reliable power control.

Power control of induction motors
Drawing from over a century of industrial manufacturing experience, ABB provides a simple and reliable approach to power control: the ACS 1000 family of drives for speed and torque control of 315 to 5000 kW induction motors for voltages of 2.3, 3.3, 4.0 and 4.16 kV. It is available with air or water cooling.

The air cooled drive can be supplied with separate input transformer (ACS 1000) or as a fully integrated drive (ACS 1000i) which includes input transformer and, optionally, input contactor.

Operational experience
With over one thousand installations worldwide, the ACS 1000 family is one of the most successful variable speed drives in its class.

Since its introduction in 1997, it has set the benchmark for reliable and efficient control of medium voltage applications such as pumps, fans, conveyors, extruders and compressors.

Key product features

- Retrofit-ready for existing motors and suitable for most medium voltage applications
- Output sine filter for pure sinusoidal voltage and current output: standard motors, no motor derating, no voltage stress and no common mode voltages on the motor insulation
- Fuseless design for reliable, non-aging, maintenance-free circuit protection
- DTC control platform for exceptionally high torque and speed control performance
- Integrated or separate input transformer for highest system design flexibility
- High level of personal safety due to arc protection

Fields of application

Industries	Applications
Cement, mining and minerals	Conveyors, crushers, mills, fans and pumps
Chemical, oil and gas	Pumps, compressors, extruders, mixers and blowers
Marine	Thrusters, pumps and compressors
Metals	Fans and pumps
Pulp and paper	Fans, pumps, refiners, vacuum pumps and chippers
Power generation	Fans, pumps, conveyors and coal mills
Water	Pumps
Other applications	Test stands and wind tunnels

Retrofit-ready simplicity

The ACS 1000 family is optimized for retrofits. With its network-friendly diode rectifiers, the motor-friendly output sine filter and its input transformer flexibility, it can fit where you need it.

Network friendly
Depending on the network conditions, the drives of the ACS 1000 family can be equipped with a 12- or 24-pulse diode rectifier which meets the stringent requirements for current and voltage harmonic distortion as defined by IEEE, IEC and EN. This eliminates the need for costly harmonic analysis or installation of network filters when applying a new drive.

Output sine filter – perfect for standard motors and retrofit applications
Voltage reflections and common mode voltages, caused by any inverter topology, are a real concern for medium voltage motors. They cause excessive stress to a standard motor insulation and create harmful bearing currents, both with potentially disastrous consequences. Furthermore, the motor is subjected to additional harmonic heating generated by the inverter switching if no further precautions are taken.

With an ACS 1000 or ACS 1000i, all these detrimental effects are totally eliminated by its unique output sine filter, being an integral part of the drive. The result is an excellent waveform of voltage and current, supplied to the motor.

Benefits
- Compatibility with standard induction motors without derating
- Ability to retrofit to existing motors
- Motor efficiency same as Direct-On-Line (DOL) operation
- Reduced motor noise
- Use of standard cables
- No limitation of motor cable length

System design flexibility
The ACS 1000 family can be configured with either an integrated dry-type or separately installed input transformer. This flexibility enables the use of oil-filled transformers when the transformer will be mounted outdoors. The advantage is that heat losses from the input transformer are not dissipated in the electrical room. The integrated input transformer, on the other hand, simplifies installation and commissioning (three cables in - three cables out).

The ACS 1000 drives family provides smooth and accurate motor control even at low speed and full torque (left diagram: 10 Hz, 100% torque) throughout the full operating range of speed and load (right diagram: 60 Hz, 100% torque).

Reliable and efficient components

Reliable components

IGCT semiconductors

The ACS 1000 and ACS 1000i use a power semiconductor known as IGCT (Integrated Gate Commutated Thyristor), which is an ideal switch for high-powered medium voltage applications. The use of IGCTs results in low parts count, providing an efficient and reliable drive.

Fuseless

The converter design does not require any medium voltage power fuses, which are known to be unreliable, costly and subject to aging. The ACS 1000 and ACS 1000i use dedicated IGCTs, instead, which provide faster and better protection for the power components.

Long-life capacitors

Electrolytic capacitors, which have a poor life expectancy, are not used in the ACS 1000 and ACS 1000i. Advanced, environmental friendly, rapeseed oil-filled foil capacitors, designed for a long lifetime, are used instead.

Powerful motor control platform

The motor control platform of the ACS 1000 drives family is ABB's award-winning Direct Torque Control (DTC). It provides rapid, accurate and stepless control from zero to full speed and can deliver full torque with optimal speed accuracy over the whole speed range, even without encoder.

Power loss ride through

A special feature of DTC is its ability to ride through short main supply voltage interruptions so that in most cases the process is not affected.

High level of personal safety

Electric arcs represent a hazard source for people and goods. For systems where large and dangerous arc fault currents can occur, special attention is required.
Therefore, the ACS 1000 and ACS 1000i fulfill the IAC requirements for arc containment assuring personal safety. For higher currents, the ACS 1000 cabinet can be equipped with a pressure relief flap. Optionally, the ACS 1000 and ACS 1000i are available with ABB's Arc Guard System™ for very fast arc detection.

The ACS 1000 drives family's well proven three-level inverter, without series or parallel connected power semiconductors, is one of the least complex, most robust and efficient drive topologies.

ACS 1000 air cooled

Cable connection section for top and bottom entry/exit

Integrated fan for low noise level

IGCT power semiconductors

Control electronics mounted on swing frame

Application and motor control board with fast digital signal processor and DTC

Fiber optics for noise immunity and galvanic isolation

12-pulse input bridge as standard

24-pulse input bridge as option

Output filter capacitor

ACS 1000 water cooled

Cable connection section for top and bottom entry/exit

IGCT inverter stacks on swing frame for easy access

Control electronics mounted on swing frame

Application and motor control board with fast digital signal processor and DTC

Fiber optics for noise immunity and galvanic isolation

Output filter choke

12-pulse input bridge as standard

24-pulse input bridge as option

Water cooling cabinet with heat exchangers and deionization unit

ACS 1000i air cooled with integrated input transformer and input contactor (optional)

Features and benefits

Features	Advantages	Benefits
Flexible input transformer configuration		
	The air cooled drives of the ACS 1000 family are available with integrated or separate input transformer, which can be placed outside the electrical room.	– Integrated transformer for quick installation and commissioning – Separate transformer reduces the air-conditioning requirements. The losses from the transformer do not dissipate into the electrical room
Network and motor friendliness		
	The 12-/24-pulse rectifier meets the most stringent requirements of international standards for current and voltage harmonic distortion.	Minimum network harmonics to avoid system interferences and utility penalties
	The sine filter gives an excellent output waveform, eliminating harmonics and common mode voltage and reducing stress on the motor.	– Elimination of voltage stresses for a longer motor lifetime – Motors can be used without derating and long cable runs between motor and drive are not a problem
Reliable and efficient components		
	ABB's IGCT high power switching device results in low parts count, providing an efficient and reliable converter. The cooling equipment is available with redundant fans or pumps.	High reliability for minimum downtime
Direct Torque Control (DTC)		
	The fast control provided by Direct Torque Control (DTC) allows optimum process control and exact motor performance with minimum torque ripple and lowest energy consumption	Fast, accurate and robust process control for constant product quality, minimum raw material waste and minimum machinery wear
	A special feature of DTC is its ability to ride through short main supply voltage interruptions	Power loss ride through
Simple access		
	The ACS 1000 and ACS 1000i have been designed to allow easy front access	Simple and efficient maintenance
Arc protection		
	The ACS 1000 and ACS 1000i are IAC classified	High level of personal safety
DriveMonitor™ (optional)		
	DriveMonitor™ provides monitoring access to the drive even from remote locations	User-friendly drive monitoring and remote diagnostics
Service and support		
	ABB, the largest drives supplier worldwide, has a global support network, which provides assistance and spare parts 24 hours/day, 365 days/year	Around the clock access to drive specialists and spare parts

Simple drive system integration

The ACS 1000 and ACS 1000i allow smooth and simple system integration into the customer's industrial environment.

Flexible control interface
ABB offers an open communication strategy, enabling connection to higher-level process controllers. The ACS 1000 and ACS 1000i can be installed with all major fieldbus adapters for smooth integration, monitoring and controlling of different processes, according to customer requirements.

DriveOPC
DriveOPC is a software package, which allows communication between ABB drives and the customer's Windows®-based applications.

Benefits
- Standard interface
- Remote connection via LAN (Local Area Network)
- Access to:
  - drive control
  - signals and parameters
  - data and fault loggers

Monitoring and diagnostics

The ACS 1000 and ACS 1000i are available with an intelligent remote monitoring and diagnostics system, which allows secure access to the drive from any location in the world.

DriveMonitor™ allows real-time access to the drive. It supports monitoring and diagnostics of ABB drives for new and existing installations.

The optional tool consists of a hardware module, as well as a software layer that automatically collects and analyzes selected drive signals and parameters.

Long-term monitoring functions deliver important information on equipment status, maintenance tasks needed and possible performance improvements. Diagnostic procedures and trending can cover not only the converter itself but other parts of the shaft train as well.

Benefits
- Early detection to avoid costly repairs
- Reduction of process-critical faults
- Optimization of maintenance cost and schedule over the product life cycle
- Long-term statistics for optimization of process performance
- Easier root cause analysis – reduced Mean Time To Repair (MTTR)

Testing, service and support

The ACS 1000 and ACS 1000i are backed by unrivalled service and support from the customer's initial inquiry throughout the entire life cycle of the drive system.

Testing
ABB is committed to ensuring the reliability of every drive it delivers. To ensure that quality standards and customer requirements are fully met, every component of a drive is subjected to thorough testing in ABB's modern test facilities.

Routine tests and functional tests form an integral part of the scope of supply of ABB's medium voltage drives. They are performed in accordance with international standards and ABB quality assurance procedures.

Additionally, ABB can perform a combined test with the complete drive system – including transformer, converter and motor – to verify the performance and to ensure a smooth integration into the customer's facility.

Installation and commissioning
Proper installation and commissioning of the equipment, done by qualified and certified commissioning engineers, reduces start-up time, increases safety and reliability and decreases life cycle costs. In addition, operators can be given practical training by experienced specialists on site.

Training
ABB provides extensive training for its medium voltage drives. A range of training programs is offered from basic tutorials to programs tailored to the customer's specific needs.

Life cycle management
ABB's drive life cycle management model maximizes the value of the equipment and maintenance investment by maintaining high availability, eliminating unplanned repair costs and extending the lifetime of the drive.

Life cycle management includes:
- providing spare parts and expertise throughout the life cycle
- providing efficient product support and maintenance for improved reliability
- adding functionality to the initial product

Global network, local presence
Aftersales service is an integral part of providing the customer with a reliable and efficient drive system. The ABB Group of companies operates in more than 100 countries and has a worldwide network of service operations.

Services for ABB's medium voltage drives
- Supervision of installation and commissioning
- Local support
- Worldwide service network
- Spare parts and logistics network
- Training
- Remote diagnostics
- 24 x 365 support line
- Customized maintenance contracts

Data sheet ACS 1000, ACS 1000i

Inverter type
Three-level Voltage Source Inverter (VSI) with fast-switching power semiconductors – Integrated Gate Commutated Thyristors (IGCTs), without parallel or series connected devices

Motors
Induction motors;
ACS 1000: 315 – 2000 kW air cooled
1800 – 5000 kW water cooled
ACS 1000i: 315 – 2000 kW air cooled

Standards
All common standards including EN (IEC), CE, UL, cUL, GOST

Input
ACS 1000:
Any medium voltage level, 50 Hz or 60 Hz, can be applied to the appropriate primary side of the converter input transformer.

ACS 1000i:
Voltage range: 4.16 – 7.2 kV, 60 Hz/6.0 – 6.6 kV, 50 Hz, on request up to 11 kV

Variation (ACS 1000, ACS 1000i):
-5% / +10% of nominal voltage, down to -25% safe operation with derated output.
Higher variation on request.

Auxiliary voltage
400 VAC ±10%, 50/60 Hz
480 VAC ±10%, 60 Hz
575 VAC ±10%, 60 Hz, 3 phase

UPS (Uninterruptible Power Supply)
If available, an UPS can be connected for control power supply, 110 – 240 VAC ±10%, single phase. Alternatively the drive can be equipped with back-up batteries.

Output frequency
0 to ±66 Hz (±82.5 Hz optional)

Output voltage
Standard: Sinusoidal, 0 – 2.3 kV,
0 – 3.3 kV, 0 – 4.0/4.16 kV
Nominal output voltage 4.0 kV according to NEMA MG1. 4.16 kV is available on request.

Input bridge
ACS 1000 Standard: 12-pulse
Optional: 24-pulse
ACS 1000i Standard: 24-pulse

Efficiency of converter
ACS 1000 typically > 98%
ACS 1000i typically > 96% (incl. integrated transformer)

Input power factor
Fundamental: > 0.97; Total: > 0.96

Overload capacity
Standard: Normal use, 10% short term overload capacity allowed for one minute every 10 minutes
Optional: For higher overload capacity contact ABB

Ambient temperature
+1° C to 40° C / 34° F to 104° F (higher with derating)

Enclosure classes
ACS 1000
Air cooled: IP21, IP22, IP31, IP32, IP42
Water cooled: IP31, IP54
ACS 1000i IP21, IP42

Control interface (optional)
- All common fieldbuses including Profibus, Modbus, Allen-Bradley DeviceNet, Ethernet, ABB Advant Fieldbus AF100 (others on request)
- Extensive range of additional I/O features available

Standard protection functions
Auxiliary voltage fault, cabinet temperature supervision, overcurrent, short circuit detection, earth fault, input phase loss, output phase loss, overvoltage, motor overload, motor underload, motor stall and overspeed protection, communication fault, main circuit breaker supervision and many others

Maritime properties
- Marine certification: available for ABS, CCS, DNV
- Mechanics: Vibration dampers, maritime handgrips, anti-condensation heaters, locking device for 90° open doors

Example options
- Motor supervision I/Os
  - Fault/alarm: overtemperature, vibration of bearings
  - PT 100: winding and bearing temperatures
- Transformer supervision I/Os:
  - Fault/alarm: overtemperature, Buchholz
  - PT 100: winding temperatures
- Hardwired signals for remote drive control
  - References: start/stop, speed/torque, etc.
  - Status feedback signals: ready/running
  - Analog signals: current/voltage/power, etc.
- Redundant cooling for enhanced reliability
- Braking chopper for effective motor braking and short deceleration times
- Bi-directional bypass (start-up bypass for synchronous transfer of up to 4 motors to the line and taking back machine from line to VSD operation)
- ABB DriveMonitor™ for remote monitoring and diagnostics
- ABB Arc Guard System™ for very fast arc detection

Data sheet ACS 1000i with integrated transformer

Motor data			Converter	Converter data			
Voltage **	Shaft power *		Type code	Power	Current *	Length	Weight ***
kV	kW	hp		kVA	A	mm	kg
3'300 V - air cooled							
3.3	315	420	ACS 1043-A1-A	400	70	3300	3900
3.3	355	480	ACS 1043-A1-B	450	79	3300	3900
3.3	400	540	ACS 1043-A1-C	500	87	3300	3900
3.3	450	600	ACS 1043-A1-D	550	96	3300	3900
3.3	500	670	ACS 1043-A1-E	600	105	3300	3900
3.3	560	750	ACS 1043-A1-F	700	122	3300	4300
3.3	630	840	ACS 1043-A2-G	750	131	3300	4300
3.3	710	950	ACS 1043-A2-H	850	149	3300	4300
3.3	800	1'070	ACS 1043-A2-J	950	166	3300	4300
3.3	900	1210	ACS 1043-A2-K	1100	192	3300	4300
3.3	1000	1340	ACS 1043-A2-L	1200	210	3300	5100
3.3	1120	1500	ACS 1043-A3-M	1350	236	3300	5100
3.3	1250	1680	ACS 1043-A3-N	1500	262	3300	5100
3.3	1400	1880	ACS 1043-A3-P	1700	297	3300	5500
3.3	1500	2010	ACS 1043-A3-Q	1900	332	3300	5500
4'000 V / 4'160 V - air cooled							
4.0	300	400	ACS 1044-A1-A	400	58	3300	4000
4.0	340	450	ACS 1044-A1-B	400	58	3300	4000
4.0	370	500	ACS 1044-A1-C	450	65	3300	4000
4.0	450	600	ACS 1044-A1-D	550	79	3300	4000
4.0	520	700	ACS 1044-A1-E	650	94	3300	4000
4.0	600	800	ACS 1044-A1-F	750	108	3300	4000
4.0	670	900	ACS 1044-A1-G	800	115	3300	4000
4.0	750	1000	ACS 1044-A1-H	900	130	3300	4000
4.0	930	1250	ACS 1044-A2-J	1150	166	3300	4900
4.0	1120	1500	ACS 1044-A2-K	1350	195	3300	4900
4.0	1300	1750	ACS 1044-A3-L	1550	224	3300	5600
4.0	1490	2000	ACS 1044-A3-M	1800	260	3300	5600
4.0	1680	2250	ACS 1044-A3-N	2000	289	3300	5600
4.0	2010	2700	ACS 1044-A3-P	2330	347	3300	5600

Notes:

* Indicative information only.
** Higher output voltages available with step-up transformer.
*** Weight indications are approximate; based on 6.0–6.6 kV/50 Hz line supply voltage.

Typical ACS 1000i diagram

General dimension	Frame size A1	Frame size A2/A3
Cabinet height	2050 mm (6 ft 7 in) excl. cooling fans	2150 mm (7 ft 1 in) excl. cooling fans
	2517 mm (8 ft 3 in) incl. fan hood	2562 mm (8 ft 4 in) incl. fan hood
	2617 mm (8 ft 6 in) incl. redundant fan hood and/or IP 42	2662 mm (8 ft 7 in) incl. redundant fan hood and/or IP 42
Cabinet depth	1121 mm (3 ft 8 in)	1121 mm (3 ft 8 in)

Data sheet ACS 1000 for induction motors (external transformer)

Motor data			Converter	Converter data			
Voltage **	Shaft power *		Type code	Power	Current *	Length	Weight ***
kV	kW	hp		kVA	A	mm	kg
			2'300 V - air cooled				
2.3	300	400	ACS 1012-A1-A	400	100	3000	1600
2.3	340	450	ACS 1012-A1-B	400	100	3000	1600
2.3	370	500	ACS 1012-A1-C	450	113	3000	1600
2.3	450	600	ACS 1012-A1-D	550	138	3000	1600
2.3	520	700	ACS 1012-A1-E	650	163	3000	1600
2.3	600	800	ACS 1012-A1-F	750	188	3000	1600
2.3	670	900	ACS 1012-A1-G	800	201	3000	1600
2.3	750	1000	ACS 1012-A1-H	900	226	3000	1600
2.3	930	1250	ACS 1012-A2-J	1150	289	3000	1750
2.3	1120	1500	ACS 1012-A2-K	1350	339	3000	1750
2.3	1300	1750	ACS 1012-A3-L	1550	389	3000	2000
2.3	1490	2000	ACS 1012-A3-M	1800	452	3000	2000
2.3	1680	2250	ACS 1012-A3-N	2000	502	3000	2000
			3'300 V - air cooled				
3.3	315	420	ACS 1013-A1-A	400	70	3000	1600
3.3	355	480	ACS 1013-A1-B	450	79	3000	1600
3.3	400	540	ACS 1013-A1-C	500	87	3000	1600
3.3	450	600	ACS 1013-A1-D	550	96	3000	1600
3.3	500	670	ACS 1013-A1-E	600	105	3000	1600
3.3	560	750	ACS 1013-A1-F	700	122	3000	1600
3.3	630	840	ACS 1013-A1-G	750	131	3000	1600
3.3	710	950	ACS 1013-A1-H	850	149	3000	1600
3.3	800	1070	ACS 1013-A2-J	950	166	3000	1750
3.3	900	1210	ACS 1013-A2-K	1100	192	3000	1750
3.3	1000	1340	ACS 1013-A2-L	1200	210	3000	1750
3.3	1120	1500	ACS 1013-A2-M	1350	236	3000	1750
3.3	1250	1680	ACS 1013-A2-N	1500	262	3000	1750
3.3	1400	1880	ACS 1013-A2-P	1700	297	3000	1750
3.3	1600	2150	ACS 1013-A3-Q	1900	332	3000	2000
3.3	1800	2410	ACS 1013-A3-R	2150	376	3000	2000
3.3	2000	2680	ACS 1013-A3-S	2400	420	3000	2000
			3'300 V - water cooled				
3.3	2000	2680	ACS 1013-W1-S	2400	420	4200	3300
3.3	2250	3020	ACS 1013-W1-T	2700	472	4200	3300
3.3	2500	3350	ACS 1013-W1-U	3000	525	4200	3300
3.3	2800	3750	ACS 1013-W2-V	3350	586	4700	3680
3.3	3150	4220	ACS 1013-W2-W	3750	656	4700	3680
3.3	3550	4760	ACS 1013-W2-X	4250	744	4700	3680
			3'300 V - water cooled				
3.3	4000	5360	ACS 1013-W3-Y	4750	831	4700	3680
3.3	4500	6030	ACS 1013-W3-Z	5350	936	4700	3680
3.3	5000	6710	ACS 1013-W3-1	5950	1041	4700	3680

Data sheet ACS 1000 for induction motors (external transformer) continued

Motor data			Converter	Converter data			
Voltage **	Shaft power *		Type code	Power	Current *	Length	Weight ***
kV	kW	hp		kVA	A	mm	kg
4'000 V - air cooled							
4.0	300	400	ACS 1014-A1-A	400	58	3000	1600
4.0	340	450	ACS 1014-A1-B	400	58	3000	1600
4.0	370	500	ACS 1014-A1-C	450	65	3000	1600
4.0	450	600	ACS 1014-A1-D	550	79	3000	1600
4.0	520	700	ACS 1014-A1-E	650	94	3000	1600
4.0	600	800	ACS 1014-A1-F	750	108	3000	1600
4.0	670	900	ACS 1014-A1-G	800	115	3000	1600
4.0	750	1000	ACS 1014-A1-H	900	130	3000	1600
4.0	930	1250	ACS 1014-A2-J	1150	166	3000	1750
4.0	1120	1500	ACS 1014-A2-K	1350	195	3000	1750
4.0	1300	1750	ACS 1014-A3-L	1550	224	3000	2000
4.0	1490	2000	ACS 1014-A3-M	1800	260	3000	2000
4.0	1680	2250	ACS 1014-A3-N	2000	289	3000	2000
4.0	1860	2500	ACS 1014-A3-P	2300	330	3000	2000
4'000 V - water cooled							
4.0	1860	2500	ACS 1014-W1-P	2300	332	4200	3300
4.0	2240	3000	ACS 1014-W1-Q	2700	390	4200	3300
4.0	2610	3500	ACS 1014-W2-R	3100	447	4700	3680
4.0	2980	4000	ACS 1014-W2-S	3600	520	4700	3680
4.0	3360	4500	ACS 1014-W2-T	4000	577	4700	3680
4.0	3730	5000	ACS 1014-W2-U	4500	650	4700	3680
4.0	4100	5500	ACS 1014-W3-V	4900	707	4700	3680
4.0	4470	6000	ACS 1014-W3-W	5300	765	4700	3680
4.0	5250****	7035	ACS 1014-W3-X	6090	879	4700	3680

Notes:

* Indicative information only.
** Higher output voltages available with step-up transformer.
*** Weight indications are approximate.
**** Motor shaft power up to 5600 kW is available on request.

Typical ACS 1000 diagram

General dimension	Air cooled	Water cooled
Cabinet height	2005 mm (6 ft 6 in)	2020 mm (6 ft 6 in)
	2070 mm (6 ft 8 in) incl. lifting eyes	2070 mm (6 ft 8 in) incl. lifting eyes
	2285 mm (7 ft 6 in) incl. air exhaust hood	
Cabinet depth	900 mm (3 ft)	900 mm (3 ft)

Contact us

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Important note on main circuit breaker design for frequency converters

Function of the MCB

The main circuit breaker (MCB) is a major protection device of the frequency converter. If a serious fault occurs in the frequency converter, the MCB must disconnect the main power supply to the frequency converter immediately, on an open or trip command, to prevent hazard to the personnel and further damage to the equipment. Depending on the main power supply configuration of the drive system, the MCB is either located on the primary side of the converter transformer or on the primary side of the frequency converter if the frequency converter is connected directly to the line (DTL); see figure 1 for illustration.

Figure 1 shows a conceptual single-line diagram of a typical drive system, including main power supply, MCB, converter transformer, frequency converter and electrical motor.

The MCB is defined as a switching device to disconnect the power supply whenever required by the process or when a fault occurs. Typical devices used as MCBs are:

- Vacuum circuit breakers
- SF6 circuit breakers
- Fused contactors or motor control centers

A dedicated protection relay is used for:

- Transformer or converter primary cable protection (DTL)
- Transformer protection (if applicable)
- Transformer secondary cable protection (if applicable)
- Backing up the frequency converter protection

Figure 1: Drive system overview

In general, these protective measures are not included in the frequency converter as provided by ABB.

Safety and protection requirements

For safety and protection reasons, the MCB must meet the stipulated minimum requirements of the specifications of ABB MV Drives. It is the system integrator's responsibility to ensure that the minimum requirements are met and therefore ABB assumes no liability whatsoever for any damages or losses arising from non-compliance with such minimum standards by the system integrator or any other third party not under the responsibility of ABB. The minimum requirements for the MCB are stated in this note and in the respective MCB specifications, which are available for each medium voltage drive from ABB.

The safety requirements for the frequency converter are based on the following standards:

- ISO 13849-1: Safety of machinery – Safety-related parts of control systems - Part 1: General principles for design, section 6.2.6 Category 3

- IEC 60204-1: Safety of machinery – Electrical equipment of machines - Part 1: General requirements

Minimum requirements for MCB and MCB control

- The MCB open and / or trip command has to be wired directly from the frequency converter to the MCB. It is not permitted to wire the trip command through any PLC or DCS system if it is not certified to meet SIL 3 level requirements and to fulfill the timing requirements outlined below. The opening of the MCB by the frequency converter shall be possible at any time. It is not permitted to interrupt the open and / or trip command wiring (for example by a local / remote switch in the MCB).
- Whenever the MCB is in service position the frequency converter must have exclusive control of closing the MCB, local closing of the MCB is not permitted.
- The maximum opening time of the MCB shall never exceed the product or project-specific maximum time defined in the MCB specifications. Typical maximum values are defined in the table below:

	ACS 1000	ACS 2000	ACS 5000	ACS 6000	MEGADRIVE-LCI
Max. protection trip time [1]	120 ms	75 ms	75 ms	75 ms	Not applicable
Max. safety trip time [2]	250 ms	250 ms	500 ms	500 ms	500 ms

[1] Maximum allowed breaking time (open and arcing) of the breaking device after the open command has been initiated to prevent further damage to the frequency converter, e.g. diode failures.

[2] Maximum allowed time to ensure safe disconnection of the main power supply to prevent any hazard to personnel.

Figure 2: MCB opening timing diagram

- In order to meet the stipulated safety requirements, it is recommended that:
  - the MCB is equipped with two independent opening coils, or
  - the MCB is equipped with one opening coil and an undervoltage coil for monitoring of the control voltage, or
  - an upstream protection coordination scheme is provided which uses the "breaker failure" (ANSI 50BF) signal to automatically trip the upstream breaker, in case the MCB does not open. The upstream breaker must open within the maximum safety trip time after a failure has occurred.

Maintenance recommendation
The MCB trip circuits should be checked once yearly.

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Standard
ROUTINE TEST AND FACTORY ACCEPTANCE TEST DESCRIPTION

Products:

Medium voltage drives

ACS 1000

ACS 2000

ACS 5000 air cooled

Originator	P. Sterk	2012-02-23	Doc. Type	Routine Test and FAT Description		Total Pages 12
Releaser	A. Greuter	2012-02-27				
Resp Dept.	ATD1		Title	General Purpose Drives		
ABB	ABB Switzerland Ltd		Document No. 3BHS346110 ZAB E01	Language EN	Rev. Ind. C	Page 1

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General

All drives leaving the ABB Medium Voltage (MV) Drives factory pass through an extensive routine test procedure, during which the drive is tested according to the standards named below.

Upon request, an additional factory acceptance test (FAT) can be performed in presence of the customer or his representatives. The standard FAT consists of the tests marked by an "X" in *Table 1 of the chapter "Overview: routine tests and factory acceptance tests"*. Special tests can be added to the FAT but are subject to additional costs, require additional time and have to be planned well in advance.

This document describes the tests being performed during the routine test and/or during the standard FAT. For additional tests, special documentation will be provided.

In accordance with the ITP, various additional tests and checks are executed prior and during assembly to ensure highest quality. Such tests include for example a double check of all connections or printed circuit board testing. These tests are not part of the final routine test or the FAT and are not mentioned in this document.

References

- 3BHS108879 ZAB E01 – Inspection and Test Plan (ITP) ACS 1000
- 3BHS109622 ZAB E01 – Routine Test Report ACS 1000:
  Template; filled in for every drive during routine testing

- 3BHS299588 ZAB D01 – Inspection and Test Plan (ITP) ACS 2000
- 3BHS297566 ZAB E01 – Routine Test Report ACS 2000:
  Template; filled in for every drive during routine testing

- 3BHS225857 ZAB E01 – Inspection and Test Plan (ITP) ACS 5000 air cooled
- 3BHS227686 ZAB E01 – Routine Test Report ACS 5000 air cooled:
  Template; filled in for every drive during routine testing

- 3BHS303375 ZAB E01 – Factory Acceptance Test Report General Purpose Drives:
  Template; specified to the customer's demands

Applicable standards

The following standards are relevant for this specification:

- IEC 61800-4 — Adjustable speed electrical power drive systems – Part 4: General requirements – Rating specifications for a.c. power drive systems above 1000V
- IEC 61800-5-1 — Adjustable speed electrical power drive systems – Part 5: Safety requirements – Electrical, thermal and energy
- IEC 60146-1-1 — Semiconductor converters – General requirements and line commutated converters – Part 1.1: Specification of basic requirements

ACS 1000 drives and ACS 2000 4 kV drives have been additionally type tested according to:
UL 347A (NEMA IC1) — Medium Voltage Power Conversion Equipment

Overview: routine tests and factory acceptance tests

In order to release an ACS drive for dispatch, all individual test steps have to be passed successfully. The test results are stated in the Routine Test Report.

The test sequence in this document is as close as possible to the actual test sequence at the ABB's MV Drives test bays. The actual test sequence may deviate nevertheless. This has no impact on the quality or correctness of the complete test procedure.

After the drive is fully assembled, it will be placed in one of the test bays and all electrical connections (high and low voltage) will be hooked up to the factory test system. The ACS 1000 water cooled is also connected to the factory raw water cooling system. All settings will be made according to the list of protective settings and test infrastructure specific parameters

The following table compares ABB routine tests and factory acceptance tests with testing requirements according to IEC 61800-4 and IEC 60146-1-1:

Ch.	Tests	Routine test (IEC 61800-4) (IEC 60146-1-1)	Routine test ABB	FAT
1	Visual inspection	X	X	X
2	Hydraulic and pressure test (For water cooled drives only)		X	1)
3	Insulation test	X	X	1)
4	**Auxiliaries and control**			
4.1	Checking of auxiliary devices	X	X	X
4.2	Checking the properties of the control equipment	X	X	X
4.3	Checking the protective devices	X	X	X
4.4	Charging test (Only applicable for ACS 2000)		X	X
5	**Functional test**			
5.1	Rated current test		X	1)
5.2	Light load and functional test	X	X	X
	Optional tests			
	Additional tests (to be specified)			2), 3)

Table 1 Overview of routine tests and factory acceptance tests

Remark 1) These tests are performed during routine testing and are usually not repeated during FAT. If requested, they are subject to additional costs and have to be planned well in advance.
Please note that the insulation test should be performed only once, in order to avoid excessive pre-aging of the equipment. Therefore this test is not repeated during the FAT. If insisted upon, the test will be repeated but only with 80% of the test voltage according to IEC 61800-5-1.

Remark 2) Optional tests, can be conducted during factory acceptance testing. They are subject to additional costs and have to be planned well in advance.

Remark 3) Optional tests. Examples are combined testing (of transformer, drive and motor) or string testing. These tests are executed at a special location, not in Turgi. They are subject to additional costs and have to be planned well in advance.

Testing equipment and installation

The routine test and the factory acceptance test are performed in ABB MV Drives' test bays, where the device under test is supplied by a transformer to adapt the input voltage.

For rated current testing, a load choke is available. A motor, coupled with a second motor, is used for the light load and functional test.

A schematic build-up of the test bays can be seen in *Figure 1*.

	Product	Load choke	Asynchronous Motor	Auxiliary voltage supply
China Beijing	ACS 1000 ACS 2000 ACS 5000 air cooled	Up to 650 A	Up to - 1 MW or - 2.5 MW depending on motor	Up to 400 VAC (50 Hz)
India Bangalore	ACS 2000 ACS 5000 air cooled	Up to 600 A	Up to 1 MW	Up to 415 VAC (50 Hz)
Switzerland Turgi	ACS 1000 ACS 2000 ACS 5000 air cooled	Up to 2500 A	Up to 800 kW	Up to 690 VAC (50 or 60 Hz)

Figure 1 Test configuration and installation

Routine tests and factory acceptance tests

1 Visual inspection

Performed during: Routine Test and Standard FAT

The following items are checked for availability, completeness, correctness and proper assembly:

- Availability of project drawings
- Correctness of the drive's rating plate
- Visual and mechanical inspection:
  - Dimensions
  - Protection class (according to IEC 60529)
  - Labeling
  - Mechanical interfaces
  - Power cable connections
  - Auxiliary power supply
  - Drive paint finish
  - I/Os and control cabling
  - Fieldbus adapter module *)
  - Pulse encoder module *)
  - Cooling system
- Completeness and correctness of:
  - Accessories
  - Special tools *)
  - Spare parts *)

2 Hydraulic and pressure test for water cooled drives

Performed during: Routine Test

Only ACS 1000 water cooled

The cooling water circuit is checked for leakages by performing a 10 bar water pressure test. Afterwards, water circulation is activated and it is verified that the conductivity sinks below 0.5 µS/cm. Please refer to the Routine Test Report for acceptance criteria.

Please note: In order to avoid pre-aging of the equipment, it is not advised to repeat the pressure test. Therefore this test is not performed during the standard FAT.

*) If applicable

3 Insulation test

Performed during: Routine Test

All medium voltage and auxiliary power circuits of the drive are subjected to a high voltage insulation test (compare *Table 2*). Although the IEC standard 60146-1-1 only demands the test voltage to be applied for one second during routine testing, ABB applies the test voltage for 60 seconds, to ensure highest quality.

ACS 2000 or ACS 5000 air cooled drives are tested while the charging transformer is disconnected, to avoid damage to the transformer. At the end of the insulation test, the transformer is reconnected and the test of the medium voltage part (AC) is repeated, but only for 1 second (ACS 2000) or 2 seconds (ACS 5000 air cooled).

According to IEC 60146-1-1 the test is passed if no electrical breakdown occurs.

The test results, test voltages (according to IEC 61800-5-1) and drive specific information about the tested sections are indicated in the respective Routine Test Report.

Test item	Rem	Description
MV_AC		Medium voltage power part
LV1		Low voltage section 1: Auxiliary supply voltage 3 phase AC
LV2		Low voltage section 2: Control supply voltage 1 phase AC or DC
LV3	1)	Low voltage section 3: Internal control supply voltage 1 phase AC
LV4	1)	Low voltage section 4: Internal control supply voltage DC
LV5		Low voltage section 5: Drive and motor space heater
MV_I_AC	2)	Medium voltage power part, input section

Table 2 Insulation test

Remark 1) Only ACS 5000 air cooled

Remark 2) Only ACS 1000i

Please note that this test should be performed only once, in order to avoid excessive pre-aging of the equipment. Therefore this test is not repeated during the FAT. If insisted upon, the test will be repeated but only with 80% of the test voltage according to IEC 61800-5-1.

4 Auxiliaries and control

4.1 Checking of auxiliary devices

Performed during: Routine Test and Standard FAT

This test is performed by applying all required auxiliary voltages to the drive (according to its configuration).

The following items are checked:

- Correct voltage levels within the drive's internal auxiliary supply distribution
- Correct phase sequence for cooling fans / pumps
- Supervision and settings of individual circuit breakers
- Status indication from electronic power supply

4.2 Checking the properties of the control equipment

Performed during: Routine Test and Standard FAT

This test is performed by applying auxiliary and control power to the drive.

The following items are checked:

- Internal and external communication links
- Wiring of remote control inputs and outputs
- DC-link charging unit (incl. discharging) *)
- Drive cooling system:
  - Operation of cooling fans *)
  - Operation of pumps *)
  - Check and adjustment of all cooling supervision signals and functions
- Function of pushbuttons and signal lights at the drive's control door
- Correct current and voltage subprints *)
- Latest released software version loaded
- Latest released firmware version installed
- DC-link voltage measurements
- Synchronization voltage measurements *)
  (in case of an ACS 2000 with Active Front End)
- Optional devices *)

Only performed during Routine Test:

- Current measurements via primary current injection
  (testing of the current scaling and overcurrent protection function)

*) If applicable

4.3 Checking the protective devices

Performed during: Routine Test and Standard FAT

The following items are checked:

- Trip circuit (Emergency Off pushbutton, external Emergency Off signal, etc.)
- Grounding switches' functionality and mechanical door interlocking

Only performed during Routine Test:

- Protection firing *)
  (ACS 2000 and ACS 5000 air cooled)

4.4 Charging test

Performed during: Routine Test and Standard FAT

ACS 2000

The ACS 2000 has a slightly more complex charging and discharging program, which is tested before the functional test. The drive runs through the three phases of the test program:

- Charging
- Maintaining
- Active discharging

The test is passed if no faults occur.

*) If applicable

5 Functional test

5.1 Rated current test

Performed during: Routine Test

The drive is checked for flawless performance under rated output current during two hours. The test is passed if no faults occur.

In case of an ACS 1000, the test cycle consists of a nine minute period at rated inverter current (Irat) and a one minute period with maximum inverter current (Imax) followed by one minute operation at rated inverter current (Irat). Compare *Figure 2*.

In case of an ACS 2000 or ACS 5000 air cooled, the drive is run consistently for two hours at rated inverter current.

Figure 2 Example of one test cycle of an ACS 1000

The test set-up depends on the drive's topology and nominal rating. If the drive's power does not exceed the maximum current of the test bay's motor, the rated current test can be performed on the motor. Otherwise, an external load choke is used to reach rated current. The ACS 1000 is an exception because of its output sinus filter, which allows the test to be performed with motor short circuited terminals. The internal filter inductor will be used as a load choke.

Remark: If the rated current test is ordered as an optional test, the test duration can also be reduced to 30 minutes instead of two hours by reducing the total number of cycles.

5.2 Light load and functional test

Performed during: Routine Test and Standard FAT

The drive under test is operated in torque control mode with nominal speed. The drive can rotate the motor in different directions depending on the application (both 100% positive and 100% negative nominal motor speed is reached).

The drive's performance under load conditions is checked. The test is passed if no faults occur.

The light load and functional test is conducted with our standard factory facility, where the output power is based on the local infrastructure (see *chapter "Testing equipment and installation"*).
Therefore – depending on the drive's size – 100% torque and full power of the drive might not always be possible.

Prior to the light load and functional test as described above, the ACS 1000 drives are operated in breaking mode for 10 minutes. The performance under maximum DC-link voltage is checked.

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ACS 1000

Technical Specification for Power Cables

Based on			Project		
Prep. S. Imboden					
Appr. F. Frank					
Doc. kind Title	Doc. des.	Item des.			
	Resp. dept.				
ABB Switzerland Ltd	Document number 3BHS189994 ZAB E01	Lang. EN	Rev. ind. 0	Page 1	No. of p. 10

General

The connection from the mains supply to the ACS 1000 drive and from drive to motor comprises following MV power cables:

- Transformer primary cables
- Transformer secondary cables
- Motor cables.

Recommendations for the installation of these components are given below. All applicable manufacturer's instructions and local regulations must be followed when installing this equipment.

Transformer Primary Cables

The cables from the Main Circuit Breaker (MCB) to the Transformer primary side got no special requirements with respect to frequency converter operation. It should carry a voltage rating consistent with the voltage present in the primary circuit. The ampacity rating should be consistent with the size of the transformer being supplied and the protection settings of the protection equipment. Derating of cable ampacity in accordance with maximum expected ambient temperature, raceway fill factors and any other factors required by local electrical codes should be applied. Installation should be in compliance with standard industrial practice for medium voltage equipment.

If required by local electrical code, an equipment safety ground wire should be supplied either separately or by including it in the 3- core cable. The ampacity of this conductor should be in accordance with the code.

Transformer Secondary Cables

The cables from the transformer secondary windings to the ACS 1000 main power input terminals, are exposed to common mode voltages, resulting from normal inverter operation. For this reason it is necessary to use cables rated for insulation levels of 5 kV (phase to earth) or higher for all transformer secondary connections, regardless of the transformer secondary voltage level (1327 V, 1903 V, or 2305 V). Cables rated for 5 kV are typically used in North America, in Europe and Asia cables rated for 6kV/10 kV are common.

In order to insure compliance with EMC requirements and to provide a low impedance, high frequency path for common mode currents, a shielded cable is recommended. Shields should be terminated and grounded at the shortest possible way at both cable termination points. The ACS 1000 power terminal section includes a ground bus in order to facilitate above requirement.

A non-shielded cable with a continuous corrugated aluminum armor may be used as an alternative to the shielded cable described above. Steel wire armored or interlocked aluminum armored cables without extra shield should not be used. Cable terminal ends with electrical contact all around its

periphery to the armor should be used to terminate the cable ends to the ground.

The ampacity rating of the cable should be in consistency with 125% of the transformer nominal output current and the settings of the protection equipment in order to allow for the harmonic content. Derating of cable ampacity in accordance with maximum expected ambient temperature, raceway fill factors and any other factors required by local electrical codes should be applied. Installation should be in compliance with standard industrial practice for medium voltage equipment.

If required by local electrical code, an equipment safety ground wire should be supplied separately. The ampacity of this conductor shall be in accordance with the code.

For information regarding the maximum length of the transformer secondary cables see *tables B-1 and B-2*

Motor Cables

There are no special requirements to be considered for the motor cables with respect to frequency converter operation. The maximum cable length is limited to 1000 m (3281 ft). A voltage rating consistent with the voltage present at the motor must be selected. The ampacity rating should be consistent with the size of the motor being supplied and the overload settings of the motor protection software. Derating of cable ampacity in accordance with maximum expected ambient temperature, raceway fill factors, and any other factors required by local electrical codes should be applied. Installation should comply with standard industrial practice for medium voltage equipment.

Cable screening is not required for the motor cables, since the converter output voltage and current are sinusoidal. Therefore no measures against common mode currents are needed.

If required by local electrical code an equipment safety ground wire should be supplied separately. The ampacity of this conductor shall be in accordance with the code.

Motor cables are terminated within the ACS 1000 cabinet in the same way as the transformer secondary cables (see *Figure A-6*).

Power Cable Dimensions

In order to determine the exact dimensions for a specific project, the actual situation (method of installation, voltage drop due to cable length etc.) and local regulations must be considered. Refer also to the specifications supplied by the power cable manufacturer.

Cable Routing

POWER CABLES

Routing of mains and motor cables must be carried out in compliance with the local regulations and according to the specifications and recommendations of the cable manufacturer.

- For best EMC performance, shielded three phase cables are recommended.
- If single phase cables are used, the cables with the three different phases must be grouped close together to ensure best EMC performance.
- Phase interchange must be accomplished according to local regulations.
- The maximum allowable number of cables per phase is given in *Table A-3*.

If the cross-section of the cable shielding is less than 50% of the cross-section of one phase, an additional grounding wire should be laid along the power cables to avoid excessive heat losses in the cable shieldings. Please refer to the local regulations for further details.

CABLE TERMINATION

Cables must be terminated with connectors according to the cable manufacturer's requirements.

GROUNDING WIRE

Routing of the grounding connection must comply with local regulations.

ACS 1000 Cable Entry and Termination

Access to the power termination section of the ACS 1000 is via the control cabinet, located on the left of the converter. A bolted access door is located behind the control swing frame. Once the access door is opened all power terminations are readily available. As an aid to interfacing the main power connections, removable bus stubs are included.

Figure A-6 shows a typical example of how transformer and motor cables are connected to the internal bus system of the ACS 1000.

Cables can be entered through the cabinet roof or from the bottom. If the cable entry is from below, the gland plates mounted on top of the cable termination section must be relocated to the bottom and the bottom cover plate must be fixed to the top of the cabinet.

Figure A-6 Principle of Power Cable Entry (Water-Cooled Type)

Table A-3 Maximum Number of Cables per Phase

	2.3 kV	***3.3 kV***	***4.0 kV***
A1	1	1	1
A2	2	1	1
A3	2	2	1
W1	-	2	2
W2	-	2	2
W3	-	3	2

The figures indicated in *Table A-3* are valid for transformer and motor cables. The maximum cable diameter (to fit through the gland holes) is 45 mm.

Transformer Connection Diagram for 12-Pulse ACS 1000

Figure A-7 Typical 3-Line Transformer Connection Diagram.

Transformer Connection Diagram for 24-Pulse ACS 1000

Figure A-8 Typical 3-Line Transformer Connection Diagram

Motor Connection Diagram for 12 / 24-Pulse ACS 1000

Figure A-9 Typical 3-Line Motor Connection Diagram

Appendix: General Technical Data

Transformer Connection / Converter Input

PRIMARY SIDE VOLTAGE

Any medium voltage level can be applied to the primary side of the converter input transformer.

SECONDARY SIDE VOLTAGE

Transformer secondary side / converter input voltages (no load) for 12 / 24-pulse ACS 1000:

- 1327 VAC, ± 10% for 2.3 kV motors
- 1903 VAC, ± 10% for 3.3 kV motors
- 2305 VAC, ± 10% for 4.0 kV motors

Safe operation with reduced output power is possible down to -25%.

PHASE SHIFT

Phase shift between transformer secondary windings:

- 30° for 12-pulse ACS 1000
- 15° for 24-pulse ACS 1000

FREQUENCY RANGE

50 / 60 Hz

VOLTAGE UNBALANCE

max. ± 2% $(U_{max} - U_{min}) / U_{avg}$

FUNDAMENTAL POWER FACTOR

$\cos \varphi 1 > 0.97$

TOTAL POWER FACTOR

$\cos \varphi T > 0.95$

TRANSFORMER SECONDARY CABLES

Depending on the presence of a *Common Mode Choke* (CMC) in the ACS 1000, the maximum permitted length for the transformer secondary cables is as follows:

Table B-1 ACS 1000 without CMC

ACS1000 Types	Rectifier Type	Max. cable length
Air-cooled	12-pulse	30 m (98 ft)
Water-cooled	12-pulse	30 m (98 ft)
Air-cooled	24-pulse	20 m (66 ft)
Water-cooled	24-pulse	20 m (66 ft)

Table B-2 ACS 1000 with CMC

ACS1000 Types	Rectifier Type	Max. cable length
Air-cooled	12-pulse	200 m (656 ft)
Water-cooled	12-pulse	200 m (656 ft)
Air-cooled	24-pulse	Not available with CMC
Water-cooled	24-pulse	150 m (492 ft)

Converter Output / Motor Connection

NOMINAL VOLTAGE

U_{Nom}: 2.3 kVAC, 3.3 kVAC, 4.0 kVAC

OPERATIONAL VOLTAGE

U_{Out}: 0... U_{Nom}, 3-phase, sinusoidal, symmetrical

OUTPUT FREQUENCY

0...66 Hz (optional: 0...82.5 Hz)

FREQUENCY RESOLUTION

0.01 Hz

SHORT TERM OVERLOAD CAPACITY

1 min/10 min: 110% of rated current

FIELD WEAKENING POINT

≥ 45 Hz

SWITCHING FREQUENCY

1 kHz (3-level inverter, operating at 2 x 500 Hz)

MAXIMUM MOTOR CABLE LENGTH

1000 m (3281 ft)

REVISION

Rev. ind.	Page (P) Chapt.(C)	Description	Date Dept./Init.
Draft		All	22.09.2003 ATDC / SI
0		First issue	24.09.2003 ATDA / FF

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SINAMICS S150 Converter Cabinet Units

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SINAMICS S150 Converter Cabinet Units

System overview

Overview

SINAMICS S150 Converter Cabinet Units are particularly suitable for all variable-speed single-axis drives with high performance requirements, i.e., drives with:

- high dynamic requirements
- frequent braking cycles and high braking energy levels
- four-quadrant operation

SINAMICS S150 offers high-performance speed control with excellent accuracy and a high dynamic response.

The following voltages and power ratings are available:

Line voltage	Type rating
380 ... 480 V 3 AC	110 ... 800 kW
500 ... 690 V 3 AC	75 ... 1200 kW

Degrees of protection are IP20 (standard), and as an option IP21, IP23, IP43 and IP54.

Line and motor-side components as well as additional monitoring devices can be installed in the converter cabinet units.

A wide range of electrical and mechanical components enable the drive system to be optimized individually to suit customer requirements.

Benefits

The self-commutating, pulsed infeed/regenerative unit uses IGBT technology and is equipped with a Clean Power Filter. This combination guarantees extremely line-friendly behavior which is characterized by the following:

- Negligible line harmonics as a result of the innovative Clean Power Filter (<< 1 %)
- The stringent limit values of IEEE 519-1992 are complied with, without any exceptions.
- Regenerative feedback (four-quadrant operation)
- Tolerant to fluctuations in the line voltage
- Operation on weak line supplies
- Reactive power compensation is possible (inductive or capacitive)
- High drive dynamic performance

Simple drive handling from engineering to operation thanks to

- Compact, modular design with an optimum degree of service friendliness
- Straightforward engineering
- Simple installation, as it is ready to be connected up
- Fast, menu-prompted commissioning without complex parameterization
- Clear and convenient operation using a user-friendly graphical operator panel with measured values displayed in plain text or in a quasi-analog bar display.

Applications

- Test bays
- Centrifuges
- Elevators and cranes
- Cross cutters and shears
- Conveyor belts with a high power demand and energy recovery
- Presses
- Cable winches

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Design

The SINAMICS S150 Converter Cabinet Units are characterized by their compact, modular and service-friendly design.

1. Active Interface Module with Clean Power Filter and line contactor
2. Active Line Module
3. Motor Module
4. Control Unit
5. Main control switch with fuses
6. Customer terminal block
7. Line connection (-X1)
8. Motor connection (-X2)

○ Standard version
○ Option

Design example of a SINAMICS S150 Converter Cabinet Unit

Option

1) Main control switch with fuses only with output current < 800 A

2) Line contactor with output current < 800 A or circuit-breaker with output current > 800 A available as standard

Basic design of a SINAMICS S150 Converter Cabinet Unit with a number of version-specific options

Design

Varnished PCBs

The following drive units are equipped as standard with varnished PCBs:

- Chassis format units
- Control Units
- Sensor Modules
- Terminal Modules
- Advanced Operator Panel (AOP30)

The varnish coating on the modules protects the sensitive SMD components against corrosive gases, chemically active dust and moisture.

Nickel-plated busbars

All of the copper busbars used in the converter cabinets are nickel-plated in order to achieve the best possible immunity to environmental effects. Further, the bare copper connections do not have to be cleaned for customer connections.

Note: For technical reasons, some parts of the copper busbars are not nickel-plated for some of the options.

Degrees of protection

The EN 60529 standard covers the protection of electrical equipment by means of housings, covers or equivalent, and includes:

- Protection of persons against accidental contact with live or moving parts within the housing and protection of the equipment against the ingress of solid foreign matter (touch protection and protection against ingress of solid foreign bodies)
- Protection of the equipment against the ingress of water (water protection)
- Abbreviations for the internationally agreed degrees of protection

The degrees of protection are specified by abbreviations comprising the code letters IP and two digits.

Degree of protection	**First code number** (touch protection and protection against foreign bodies)	**Second code number** (protection of the equipment against the ingress of water)
IP20 (Standard)	Protection against solid foreign bodies diameter ≥ 12.5 mm	No water protection
IP21 (Option **M21**)	Protection against solid foreign bodies diameter ≥ 12.5 mm	Protected against drip water Vertically falling water drops shall not have a harmful effect.
IP23 (Option **M23**)	Protection against solid foreign bodies diameter ≥ 12.5 mm	Protected against spray water Water sprayed on both sides of the vertical at an angle of up to 60° shall not have a harmful effect.
IP43 (Option **M43**)	Protection against solid foreign bodies diameter ≥ 1 mm	Protected against spray water Water sprayed on both sides of the vertical at an angle of up to 60° shall not have a harmful effect.
IP54 (Option **M54**)	Dust protected Ingress of dust is not totally prevented, but dust must not be allowed to enter in such quantities that the functioning or safety of the equipment is impaired.	Protected against splash water Water splashing onto the enclosure from any direction shall not have a harmful effect.

Function

AOP30 Advanced Operator Panel

An Advanced Operator Panel (AOP30) is installed in the cabinet door of the converter for operation, monitoring and commissioning tasks.

The user is guided by interactive menus through the drive-commissioning screens. When commissioning the drive for the first time, only 6 motor parameters (which can be found on a motor rating plate) have to be entered on the AOP30. The control is then optimized automatically to fine-tune the converter to the motor.

The AOP30's two-stage safety concept prevents unintentional or unauthorized changes to settings. Operation of the drive from the operator panel can be disabled by the keyboard lock so that only parameter values and process variables can be displayed on the operating panel. The OFF key is factory-set to active but can also be deactivated by the customer. A password can be used to prevent the unauthorized modification of converter parameters.

German, English, French, Italian, Spanish and Chinese are stored on the CU320-2 Control Unit CompactFlash card as operator panel languages. Russian, Polish and Czech are available in addition to these standard panel languages. These can be downloaded free of charge from the Internet under the following link:
http://support.automation.siemens.com/

Examples of plain-text displays at various phases of operation are shown below.

The **First commissioning** process is performed using the operator panel.

Only 6 motor parameters have to be entered: Power, speed, current, cos φ, voltage and frequency of the motor.

This information can be found on the motor rating plate, and must be entered into the screens on the display by following a short, menu-assisted procedure. The motor cooling method must also be specified.

The next screen contains the parameter values that are used to automatically optimize the control.

During operation, actual data are output on the display as absolute values, such as setpoint and actual values, or it is possible to parameterize up to three process variables as a quasi-analog bar display.

Any **alarms** which occur are signaled by flashing of the yellow ALARM LED, **faults** by the red FAULT LED which is then lit. There is also an indication of the cause displayed in plain text on the display's status line (with counter/remedial measures).

Function

Communication with higher-level control and customer terminal block

A PROFIBUS or PROFINET interface on the CU320-2 Control Unit is provided as standard as the customer control interface.

This interface can be used to connect the system to the higher-level controller using analog and digital signals, or to connect additional units.

The inputs and outputs available as standard can be optionally expanded by up to 2 TM31 Terminal Modules (refer to the description of options, option **G60** or **G61**). To simplify configuration and commissioning of the drive, the TM31 Terminal Module can be preset to a variety of factory settings.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

Open-loop and closed-loop control functions

SINAMICS S150 has a high-dynamic vector control with speed and current control – with and without speed actual value feedback.

Software and protective functions

The software functions available as standard are described below:

Software and protective functions	Description
Setpoint input	The setpoint can be input both internally and externally. It is applied internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint and externally via the communications interface or an analog input on the TM31 Terminal Module. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands from any interface.
Motor identification	The automatic motor identification function makes commissioning faster and easier and optimizes closed-loop control of the drive.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with adjustable rounding times in the lower and upper speed ranges, allows the drive to be smoothly accelerated and braked. This results in a good speed control response and plays its role in reducing the stress on the mechanical system. The down ramps can be parameterized separately for quick stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This may also extend the set ramp-down time.
Kinetic buffering (KIP)	For brief line supply failures, the kinetic energy of the rotating drive is used to buffer the DC link and therefore prevents fault trips. The drive converter remains operational as long as the drive can provide regenerative energy as a result of its motion and the DC link voltage does not drop below the shutdown threshold. When the line supply recovers within this time, the drive is again bumplessly accelerated up to its setpoint speed.
Automatic restart	The automatic restart switches the drive on again when the power is restored after a power failure, and ramps up to the current speed setpoint.
Flying restart	The flying restart function allows the converter to be switched to a motor that is still turning.
Technology controller	Using the technology controller (PID controller) function module, level or flow controls and complex tension controls can be implemented, for example. The existing D component can act both on the system deviation as well as on the actual value (factory setting). The P, I, and D components are separately set.
Free function blocks	Using the freely programmable function blocks, it is easy to implement logic and arithmetic functions for controlling the SINAMICS drive. The blocks can be programmed by means of an operator panel or the STARTER commissioning tool.
Drive Control Chart (DCC)	Drive Control Chart (DCC) is an additional tool for the easy configuration of technological functions for SINAMICS. The block library contains a large selection of control, arithmetic and logic blocks as well as extensive open-loop and closed-loop control functions. The user-friendly DCC Editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of diagrams that have already been created. DCC is an add-on to the STARTER commissioning tool (→ Tools and engineering).
I^2t detection for motor protection	A motor model stored in the converter software calculates the motor temperature based on the current speed and load. More exact sensing of the temperature, which also takes into account the influence of the ambient temperature, is possible by means of direct temperature sensing using KTY84 sensors in the motor winding.
Motor temperature evaluation	Motor protection by evaluating a KTY84, PTC or Pt100 temperature sensor. When a KTY84 temperature sensor is connected, the limit values can be set for alarm or shutdown. When a PTC thermistor is connected, the system reaction to triggering of the thermistor (alarm or shutdown) can be defined.
Motor blocking protection	A blocked motor is detected and protected against thermal overloading by a fault trip.

Function

Power unit protection

Power unit protection	Description
Ground fault monitoring at the output	A ground fault at the output end is detected by an aggregate current monitor and results in shutdown in grounded-neutral systems.
Electronic short-circuit protection at the output	A short-circuit at the output (e.g. at the converter output terminals, in the motor cable or in the motor terminal box) is detected and the converter shuts down with a "fault".
Thermal overload protection	An alarm is issued first when the overtemperature threshold responds. If the temperature continues to rise, the unit either shuts down or independently adjusts the pulse frequency or output current so that thermal load is reduced. Once the cause of the fault has been eliminated (e.g. cooling has been improved), the original operating values are automatically resumed.

Safety Integrated functions

The integrated safety functions of SINAMICS provide highly-effective application-oriented protection for personnel and machinery. The Safety Integrated functions are implemented electronically and therefore offer short response times in comparison to solutions with externally implemented monitoring functions.

The trend toward greater complexity and increasing modularity of machines is increasingly seeing a shift in safety functions away from the classical central safety functions (for example, shutdown of the complete machine using a main switch) and into the machine control system and the drives. Frequently, this also significantly increases the productivity. This is because, for instance, equipping times can be reduced and during these equipping times, depending on the machine type, other parts can still continue to produce.

Integrated safety functions act much faster than those of a conventional design. The safety of a machine is increased further with Safety Integrated. Furthermore, thanks to the faster method of operation, safety measures controlled by integrated safety systems are perceived as less of a hindrance by the machine operator, therefore significantly reducing the motivation to consciously bypass safety functions.

The safety functions in the device and communication via PROFIsafe have already been certified. This simplifies configuring the safety functions and especially the acceptance of the plant or system by an authorized testing body when compared to safety solutions made up of individual safety components.

Legal framework

Machine and plant builders must ensure that their machines or plants neither present risks due to electric shock, heat or radiation nor due to functional faults. In Europe, for example, compliance with the machinery directive is legally stipulated by the EU industrial safety directive.

In order to ensure compliance with this directive, it is recommended that the corresponding harmonized European standards are applied. This initiates the assumption of conformity and gives manufacturers and operators the legal security when complying with both national regulations and EU directives. The machine manufacturer uses the CE marking to document the compliance with all relevant directives and regulations in the free movement of goods.

Safety-related standards

Functional safety is specified in various standards.
EN ISO 12100 and EN ISO 14121-1, for example, are concerned with the design and risk assessment of machines. EN 62061 (only applicable for electrical and electronic control systems) and EN ISO 13849-1 (previously EN 954-1) define the functional and safety-related requirements of control systems with relevance to safety.

The above-mentioned standards define different safety requirements that the machine has to satisfy in accordance with the risk, frequency of a dangerous situation, probability of occurrence and the opportunities for recognizing impending danger.

- EN 954-1: Categories B, 1 ... 4 (from the end of 2011 will be replaced by EN ISO 13849-1)
- EN ISO 13849-1: Performance Level PL a ... e
- EN 62061: Safety Integrity Level SIL 1 ... 3

Safety functions integrated in the drive with SINAMICS

The safety functions integrated in SINAMICS satisfy the requirements of

- Category 3 according to EN 954-1 (from the end of 2011 will be replaced by EN ISO 13849-1)
- Safety Integrity Level (SIL) 2 according to EN 61508
- Performance Level (PL) d according to EN ISO 13849-1

In addition, the Safety Integrated functions of SINAMICS are generally certified by independent institutes. An up-to-date list of certified components is available on request from your local Siemens office.

Function

Safety Basic Functions and Safety Extended Functions

The Safety Integrated functions of the SINAMICS drive system are subdivided into what are known as Safety Basic Functions and Safety Extended Functions (terminology according to IEC 61800-5-2):

- **Basic Functions**
  - Safe Torque Off (STO)
  - Safe Stop 1 (SS1, time-controlled)
  - Safe Brake Control (SBC)

  The Safety Basic functions are included in the standard scope of delivery of the drive and can be used without requiring any additional license. The user can activate these functions at any time. An encoder is not required for their use.

  The Safety Basic Functions are controlled as follows:
  - Via terminals at the Control Unit and at the power unit
  - Via PROFIBUS or PROFINET with PROFIsafe profile (from version 3 (last position of the Order No. ≥ 3) and Drives SW Version V2.6 SP2)
- **Extended Functions**
  - Safe Torque Off (STO)
  - Safe Stop 1 (SS1, time-controlled and acceleration controlled)
  - Safe Stop 2 (SS2)
  - Safe Operating Stop (SOS)
  - Safely-Limited Speed (SLS)
  - Safe Speed Monitor (SSM)
  - Safe Direction (SDI)

  Safety Extended Functions require a safety license depending on the axes. Depending on the control, additional DRIVE-CLiQ components are required.

  Note: Extended Functions require a sine-cosine encoder and therefore a SMC20 Sensor Module Cabinet Mounted to evaluate the encoder signals (option **K48**).

  The Safety Extended Functions are controlled as follows:
  - Via the TM54F Terminal Module
  - Via PROFIBUS or PROFINET with the PROFIsafe profile

The Safety Integrated functions currently available in SINAMICS S150 are subsequently described in more detail (terms as defined in IEC 61800-5-2):

Safe Torque Off (STO)

Function description

This function prevents unexpected starting according to EN 60204-1 Section 5.4. Safe Torque Off disables the control of the power unit, preventing a potentially hazardous torque (corresponds to Stop Category 0 according to EN 60204-1). The drive is reliably torque-free. This state is monitored internally in the drive.

Under Extended Functions, STO can also be controlled via the TM54F Terminal Module or PROFIsafe.

Application, customer benefits

STO has the immediate effect that the drive cannot supply any torque-generating energy. STO can be used wherever the drive will naturally reach a standstill due to load torque or friction in a sufficiently short time or when "coasting down" of the drive will not have any relevance for safety.

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Function

Safe Brake Control (SBC)

Function description

The Safe Brake Control SBC is used to control holding brakes, which are active in the no-current state, e.g. motor holding brakes (actuated using spring force). The brake is controlled through two channels in a safety-relevant fashion.

Safe Brake Control is executed when activating the operational brake control, Safe Torque Off function and when safety monitoring functions respond, which cause the power unit to be safely inhibited.

Note 1: The Safe Brake Control does not detect mechanical faults in the brake, for example worn brake pads.

Note 2: An additional Safe Brake Adapter (SBA) is required (option **K88** or **K89**, for a description see SINAMICS S120 Chassis Format Units, Supplementary system components).

Application, customer benefits

In conjunction with STO and SS1, SBC can also be activated. After switching off the torque-generating energy, SBC offers the possibility to safely control a holding brake at the motor; for example, to prevent hanging/suspended axes from sagging.

Safe Stop 1 (SS1, time-controlled, without encoder; Basic Safety Function)

Function description

The Safe Stop 1 function can safely stop the drive in accordance with EN 60204-1, Stop Category 1. When the SS1 function is selected, the drive independently brakes along a quick stop ramp (OFF3) and Safe Torque Off and Safe Brake Control (if enabled) are activated when the selected safety delay time has expired.

Application, customer benefits

When activating the stop function, if the drive does not come quickly enough to a standstill as a result of the load torque, then it can be actively braked by the converter. As a result of this integrated fast brake function, frequently it is possible to eliminate mechanical brakes which wear, or to reduce the load on them. This means that maintenance costs and stress on the machine can be reduced.

Safe Stop 1 (SS1, time and acceleration controlled, with sine-cosine encoder; Extended Safety Function)

Function description

The Safe Stop 1 function can safely stop the drive in accordance with EN 60204-1, Stop Category 1. When the SS1 function is selected, the drive independently brakes along a quick stop ramp, the deceleration is monitored (OFF3) and Safe Torque Off and Safe Brake Control (if enabled) are automatically activated when the selected safety delay time has expired.

Application, customer benefits

When activating the stop function, if the drive does not come quickly enough to a standstill as a result of the load torque, then it can be actively braked by the converter. As a result of this integrated fast brake function, frequently it is possible to eliminate mechanical brakes which wear, or to reduce the load on them. This means that maintenance costs and stress on the machine can be reduced.

Function

Safe Stop 2 (SS2, with sine-cosine encoder)

Function description

The Safe Stop 2 function can safely stop the drive in accordance with EN 60204-1, Stop Category 2. When the SS2 function is selected, the drive brakes autonomously along a quick stop ramp (OFF3). In contrast to SS1, the drive control remains operational afterwards, i.e. the motor can supply the full torque required to maintain the actual position. Standstill is safely monitored (Safe Operating Stop function, SOS).

Application, customer benefits

Just the same as for SS1, the drive is independently braked when the stop function is selected. Contrary to SS1, also at standstill, the drive can provide the full torque.

Safe Stop 1 (SS1) and Safe Stop 2 (SS2) with Safe Acceleration Monitor (SAM, with sine-cosine encoder)

For the Extended Functions Safe Stop 1 (SS1) and Safe Stop 2 (SS2) with SAM, during braking, the acceleration is safely monitored (SAM) in order to identify faults already during the braking phase.

Safe Operating Stop (SOS, with sine-cosine encoder)

Function description

The Safe Operating Stop function constitutes safe standstill monitoring. The drive control remains in operation. The motor can therefore deliver the full torque to hold the current position. The actual position is reliably monitored. In contrast to safety functions SS1 and SS2, the speed setpoint is not influenced autonomously. After SOS has been selected, the higher-level control must bring the drive to a standstill within a parameterized safe time Δt and then hold the position setpoint. After the time Δt has expired, SOS is activated and monitored to ensure that the actual standstill position is not left.

Application, customer benefits

SOS is the ideal function for all those applications for which the machine or parts of the machine must be at a safe standstill for certain machining steps, but where the drive must also supply a holding torque.

Safely-Limited Speed (SLS, with sine-cosine encoder)

Function description

Using the Safely-Limited Speed function, the drive is monitored against a parameterizable maximum velocity. Four different limit values can be activated. Just the same as for SOS, the speed setpoint is not independently influenced. After SLS has been selected, the higher-level control must bring the drive to below the selected velocity limit within a parameterizable time Δt.

Application, customer benefits

When setting-up many machines operating personnel must work on the machine as it rotates. This must either be done in steps, because the dangerous area must always be exited at each start, or alternatively, the operator works at the machine while it moves and is therefore exposed to an increased risk. When using the SLS function, a considerable amount of time can be saved – and it is still guaranteed that the operating personnel are safe. For this purpose, the drive velocity can be safely limited to a safe low level. The selectable wait time until SLS is activated allows the drive control to run-down the coordinated axes in a controlled fashion.

Safe Speed Monitor (SSM, with sine-cosine encoder)

Function description

The Safe Speed Monitor function supplies a safety feedback signal (high active) if the drive falls below a selectable velocity limit value. Contrary to the functions described above, there is no drive-based fault response when the limit value is exceeded.

Application, customer benefits

The safety SSM feedback signal can be used in a higher-level control for safety-relevant responses. The higher-level safety control can flexibly respond to the signal, depending on the particular situation, as there is no drive-based response when the limit value is exceeded. For example, using the SSM signal, a protective door can be released after a non-hazardous velocity is reached.

Function

Safe Direction (SDI, with sine-cosine encoder)

Function description

The SDI function ensures that the drive can only rotate in the selected direction.

Deviation from the direction of rotation currently being monitored is detected reliably and the configured drive-integrated fault reaction is initiated. It is possible to select which direction of rotation is to be monitored.

Application, customer benefits

The SDI function is used when the drive may only move in one direction. A typical application is to permit the operator access to a danger zone, as long as the machine is rotating in the safe direction, i.e. away from the operator. In this state, the operator can feed material into the work zone/remove material from the work zone without danger.

The function saves the use of external components e.g. speed monitors and the associated wiring. The release of a danger zone, while the machine is moving away from the operator, increases productivity. Without the SDI function, the machine must be safely stopped during material loading and removal.

PROFIsafe

PROFIsafe is an open communication standard, that facilitates standard and safety-relevant communication along one communication path (hard-wired or wireless). As a consequence, a second, separate bus system is not required. The telegrams that are sent are continually monitored to ensure safety-relevant communication. Possible errors such as telegrams that have been lost, repeated or received in the incorrect sequence etc. are avoided. This is done by consecutively numbering the telegrams in a safety-relevant fashion, monitoring their reception within a defined time and transferring an ID for transmitter and receiver of a telegram. Further, a cyclic redundancy check CRC (**c**yclic **r**edundancy **c**heck) is performed.

SINAMICS S150 supports the PROFIsafe profile, based on PROFIBUS as well as on PROFINET.

Licensing

The Safety Integrated Basic Functions do not require a license.

A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended Functions. It is irrelevant which safety functions are used and how many.

A license required for SINAMICS S150 can be optionally ordered with the equipment (option **K01**).

Refer to the section Supplementary system components for the order numbers of the CompactFlash cards.

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Function

An overview of the SINAMICS Safety Integrated functions plus their boundary conditions is provided in the following table:

Function	Control	Underlying function	Reaction to limit overshoot	Encoder required	License required
Safety Basic Functions					
STO	• EP terminals on the power unit and digital input at the CU3xx/D4xx/CX32 • PROFIsafe • Terminal module (24 V to 230 V), option **K82** [1]	SBC (if activated)	–	No	No
SS1	• EP terminals on the power unit and digital input at the CU3xx/D4xx/CX32 • PROFIsafe • Terminal module (24 V to 230 V), option **K82** [1]	STO, after a parameterized delay time has expired	STO	No	No
SBC	• Via Safe Brake Adapter [2]	–	–	No	No
Safety Extended Functions					
STO	• Terminals on the TM54F [3] • PROFIsafe	SBC (if activated)	–	Yes [4]	Yes (each safety axis)
SS1	• Terminals on the TM54F [3] • PROFIsafe	STO is activated after the shutdown conditions have been fulfilled	STO	Yes [4]	Yes (each safety axis)
SBC	• Via Safe Brake Adapter	–	–	Yes [4]	Yes (each safety axis)
SS2	• Terminals on the TM54F [3] • PROFIsafe	STO is activated after the shutdown conditions have been fulfilled	STO	Yes [4]	Yes (each safety axis)
SLS	• Terminals on the TM54F [3] • PROFIsafe	Up to four maximum speeds for operation can be parameterized	STO, SS1 or SOS (can be parameterized)	Yes [4]	Yes (each safety axis)
SOS	• Terminals on the TM54F [3] • PROFIsafe	For closed-loop speed control: The position is monitored from standstill	STO or SS1 (can be parameterized)	Yes [4]	Yes (each safety axis)
SSM	• Terminals on the TM54F [3] • PROFIsafe	Safe limit value monitoring in both directions of rotation, no independent drive response. A safety-relevant signal for further operation is generated.	–	Yes [4]	Yes (each safety axis)
SDI	• Terminals on the TM54F [3] • PROFIsafe	–	STO, SS1 or SOS (can be parameterized)	Yes [4]	Yes (each safety axis)

[1] In addition for SINAMICS S120 Cabinet Modules and SINAMICS S150 Converter Cabinet Units.

[2] Safe Brake Adapter has been released from firmware version 4.4.

[3] For SINAMICS S120 Cabinet Modules and SINAMICS S150 Converter Cabinet Units as option **K87**.

[4] The Safety Integrated Extended Functions require a sine-cosine encoder to sense the motor speed. Possible encoder evaluation units SMC20, SMI20, SME20/25/120/125.

Function

The principle of operation of Safety Integrated

Two independent shutdown paths

There are two shutdown paths that are independent of one another.

All shutdown paths are low active. This therefore ensures that when a component fails or there is a wire break, then the system always goes into the safe state. When a fault is detected in the shutdown paths, the Safe Torque Off or Safe Stop 1 function (depending on the parameterization, also refer to the table on the Page 4/12) is activated and a restart is prevented.

Two-channel monitoring structure

All of the hardware and software functions important for Safety Integrated are implemented in two independent monitoring channels (e.g. shutdown paths, data management, data comparison). The safety-relevant data in the two monitoring channels is cyclically compared crosswise.

The monitoring functions in each monitoring channel are based on the principle that before a particular action, there must be a defined state, and after the action there must be a specific feedback. If this expectation is not fulfilled in a monitoring channel, then the drive is shutdown through two channels and the appropriate signal output.

Forced checking procedure using a test stop

In order to fulfill the requirements of EN 954-1 (at the end of 2011, will be replaced by EN ISO 13849-1) and IEC 61508 regarding early fault detection, the functions and the shutdown paths must be tested within a specific time period at least once to ensure that they are operating correctly. This must be realized either cyclically and manually or the test stop must be automatically initiated as part of the process. The test stop cycle is monitored, and after a specific time has been exceeded, an alarm is output.

A test top does not require a power on. The acknowledgment is realized when deselecting the test stop request.

When the machine is operational, it can be assumed that there is no risk for personnel as a result of the appropriate safety equipment (e.g. protective doors). As a consequence, the user is only made aware of the forced checking procedure that is required using an alarm, and is requested to perform the forced checking procedure at the next possible opportunity.

Examples for performing the forced checking procedure:

- When the drives are stationary after switching-on the system
- Before opening the protective door
- In a specified rhythm (e.g. every 8 hours)
- In the automatic mode, time and event-triggered

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Technical data

The most important directives and standards are listed below. These are used as basis for the SINAMICS S150 Converter Cabinet Units drive system and they must be carefully observed to achieve an EMC-compliant configuration that is safe both functionally and in operation.

European directives	
2006/95/EC	Low-voltage directive: Legal guidelines of the EU member states concerning electrical equipment for use within specified voltage limits
2004/108/EC	EMC directive: Legal guidelines of the EU member states for electromagnetic compatibility
European standards	
EN 954-1 [1]	Safety of machinery – safety-related parts of control systems; Part 1: General design principles
EN ISO 13849-1	Safety of machinery – safety-related parts of control systems; Part 1: General design guidelines (ISO 13849-1: 2006) (replaces EN 954-1)
EN 60146-1-1	Semiconductor converters – General requirements and line-commutated converters Part 1-1: Specification of basic requirements
EN 60204-1	Safety of machinery – Electrical equipment of machines; Part 1: General requirements
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 61800-2	Variable-speed electric drives Part 2: General requirements – Rating specifications for low-voltage adjustable frequency AC power drive systems
EN 61800-3	Variable-speed electric drives Part 3: EMC requirements including specific test methods
EN 61800-5-1	Adjustable-speed electrical power drive systems Part 5: Safety requirements Main section 1: Electrical and thermal requirements
EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional safety (IEC 61800-5-2: 2007)

General technical specifications

Electrical specifications	
Line voltages	380 ... 480 V 3 AC, ±10 % (-15 % < 1 min) 500 ... 690 V 3 AC, ±10 % (-15 % < 1 min)
Line supply types	Grounded TN/TT systems and non-grounded IT systems
Line frequency	47 ... 63 Hz
Output frequency [2]	
• Control type Servo	0 ... 650 Hz
• Control type Vector	0 ... 600 Hz
• Control type *V/f*	0 ... 600 Hz
Line power factor	Adjustable (factory-set to cos $\varphi = 1$)
Efficiency	> 96 %
Overvoltage category	III to EN 61800-5-1

[1] Will be replaced by EN ISO 13849-1 at the end of 2011.

[2] Please note:
- The correlation between the maximum output frequency, pulse frequency and current derating. Higher output frequencies for specific configurations are available on request.
- The correlation between the maximum output frequency and permissible output current (current derating).
  Information is provided in the SINAMICS Low Voltage Engineering Manual.

Technical data

General technical data (continued)

Electrical specifications			
Control method	Vector control with and without encoder or *V/f* control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, parameterizable (in the default setting, 3 fixed setpoints plus 1 minimum speed are selectable using terminal block/PROFIBUS/PROFINET)		
Skipped speed ranges	4, parameterizable		
Setpoint resolution	0.001 rpm digital (14 bits + sign) 12 bit analog		
Braking operation	Four-quadrant operation is possible as standard (optional via a braking unit if braking is required when power fails)		
Mechanical specifications			
Degree of protection	IP20 (higher degrees of protection up to IP54 optional)		
Protection class	I acc. to EN 61800-5-1		
Touch protection	EN 50274/BGV A3 for the intended purpose		
Cabinet system	Rittal TS 8, doors with double-barb lock, three-section base plates for cable entry		
Paint finish	RAL 7035 (indoor requirements)		
Type of cooling	Forced air cooling AF to EN 60146		
Ambient conditions	**Storage** [1]	**Transport** [1]	**Operation**
Ambient temperature	-25 ... +55 °C	-25 ... +70 °C from -40 °C [2] for 24 hours	0 ... +40 °C to +50 °C, see derating data
Relative humidity (condensation not permissible)	5 ... 95 % [2] Class 1K4 acc. to EN 60721-3-1	5 ... 95 % at 40 °C Class 2K3 acc. to IEC 60721-3-2	5 ... 95 % [2] Class 3K3 acc. to EN 60721-3-3
Environmental class/harmful chemical substances	Class 1C2 acc. to EN 60721-3-1	Class 2C2 acc. to EN 60721-3-2	Class 3C2 acc. to EN 60721-3-3
Organic/biological influences	Class 1B1 acc. to EN 60721-3-1	Class 2B1 acc. to EN 60721-3-2	Class 3B1 acc. to EN 60721-3-3
Degree of pollution	2 acc. to EN 61800-5-1	2 acc. to EN 61800-5-1	2 acc. to EN 61800-5-1
Installation altitude	Cabinet Modules, chassis format: up to 2000 m above sea level, without derating, > 2000 m, see characteristic curves/derating data For Motor Modules Booksize Cabinet Kit format as well as Central Braking Modules: up to 1000 m above sea level without derating, > 1000 m, see characteristic curves/derating data		
Mechanical stability	**Storage** [1]	**Transport** [1]	**Operation**
Vibration load	Class 1M2 acc. to EN 60721-3-1	Class 2M2 acc. to EN 60721-3-2	–
• Deflection	1.5 mm at 5 ... 9 Hz	3.1 mm at 5 ... 9 Hz	0.075 mm at 10 ... 58 Hz
• Acceleration	5 m/s² at > 9 ... 200 Hz	10 m/s² at > 9 ... 200 Hz	9.8 m/s² at > 58 ... 200 Hz
Shock load	Class 1M2 acc. to EN 60721-3-1	Class 2M2 acc. to EN 60721-3-2	Class 3M4 acc. to EN 60721-3-3
• Acceleration	40 m/s² at 22 ms	100 m/s² at 11 ms	100 m/s² at 11 ms
Compliance with standards			
Conformances/approvals, according to	CE (EMC Directive No. 2004/108/EC and Low-Voltage Directive No. 2006/95/EC)		
Radio interference suppression	SINAMICS drive converter systems are not designed for connection to the public network (first environment). Radio interference suppression is compliant with the EMC product standard for variable-speed drives EN 61800-3, "Second environment" (industrial line supplies). The equipment can cause electromagnetic interference when it is connected to the public network. However, if supplementary measures are taken (e.g. → line filter), it can also be operated in the "first environment".		

[1] In transport packaging.
[2] Deviations with respect to the specified class are underlined.

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Technical data

Line voltage 380 ... 480 V 3 AC		SINAMICS S150 Converter Cabinet Units					
		6SL3710-7LE32-1AA3	6SL3710-7LE32-6AA3	6SL3710-7LE33-1AA3	6SL3710-7LE33-8AA3	6SL3710-7LE35-0AA3	6SL3710-7LE36-1AA3
Type rating							
• For I_L (50 Hz 400 V) [1]	kW	**110**	**132**	**160**	**200**	**250**	**315**
• For I_H (50 Hz 400 V) [1]	kW	90	110	132	160	200	250
• For I_L (60 Hz 460 V) [2]	hp	150	200	250	300	400	500
• For I_H (60 Hz 460 V) [2]	hp	150	200	200	250	350	350
Output current							
• Rated current $I_{N\,A}$	A	210	260	310	380	490	605
• Base load current I_L [3]	A	205	250	302	370	477	590
• Base load current I_H [4]	A	178	233	277	340	438	460
• Max. current $I_{max\,A}$	A	307	375	453	555	715	885
Infeed/regenerative feedback current							
• Rated input current $I_{N\,E}$	A	197	242	286	349	447	549
• Max. input current $I_{max\,E}$	A	315	390	570	570	735	907
Current demand, max. [5]							
• 24 V DC auxiliary power supply	A	Internal	Internal	Internal	Internal	Internal	Internal
Pulse frequency [6]							
• Rated frequency	kHz	2	2	2	2	2	1.25
• Pulse frequency, max.							
- Without current derating	kHz	2	2	2	2	2	1.25
- With current derating	kHz	8	8	8	8	8	7.5
Power loss, max. [7]							
• At 50 Hz 400 V	kW	6.31	7.55	10.01	10.72	13.13	17.69
• At 60 Hz 460 V	kW	6.49	7.85	10.45	11.15	13.65	18.55
Cooling air requirement	m^3/s	0.58	0.7	1.19	1.19	1.19	1.96
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	71/73	71/73	72/74	72/74	72/74	77/79
Cable length, max.							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm	1400	1400	1600	1800	1800	2200
• Height	mm	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600
Weight, approx.	kg	708	708	892	980	980	1716
Frame size		F	F	G	G	G	H

Note: The power data in hp units are based on the NEC/CEC standards for the North American market.

Information about line supply connections, motor connections and cabinet grounding can be found under **Cable cross-sections and connections**.

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H with 400 V 3 AC 50 Hz.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H with 460 V 3 AC 60 Hz.

3) The base load current I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

5) If the drive closed-loop control is still to remain active when the line supply fails, then the equipment must be provided with an external 24 V DC supply.

6) Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

7) The specified power losses are the maximum values at 100 % utilization. The values are lower under normal operating conditions.

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Technical data

Line voltage 380 ... 480 V 3 AC		SINAMICS S150 Converter Cabinet Units				
		6SL3710-7LE37-5AA3	6SL3710-7LE38-4AA3	6SL3710-7LE41-0AA3	6SL3710-7LE41-2AA3	6SL3710-7LE41-4AA3
Type rating						
• For I_L (50 Hz 400 V) [1]	kW	**400**	**450**	**560**	**710**	**800**
• For I_H (50 Hz 400 V) [1]	kW	315	400	450	560	710
• For I_L (60 Hz 460 V) [2]	hp	600	700	800	900	1150
• For I_H (60 Hz 460 V) [2]	hp	450	600	700	900	1000
Output current						
• Rated current $I_{N\,A}$	A	745	840	985	1260	1405
• Base load current I_L [3]	A	725	820	960	1230	1370
• Base load current I_H [4]	A	570	700	860	1127	1257
• Max. current $I_{max\,A}$	A	1087	1230	1440	1845	2055
Infeed/regenerative feedback current						
• Rated input current $I_{N\,E}$	A	674	759	888	1133	1262
• Max. input current $I_{max\,E}$	A	1118	1260	1477	1891	2107
Current demand, max. [5]						
• 24 V DC auxiliary power supply	A	Internal	Internal	Internal	Internal	Internal
Pulse frequency [6]						
• Rated frequency	kHz	1.25	1.25	1.25	1.25	1.25
• Pulse frequency, max.						
- Without current derating	kHz	1.25	1.25	1.25	1.25	1.25
- With current derating	kHz	7.5	7.5	7.5	7.5	7.5
Power loss, max. [7]						
• At 50 Hz 400 V	kW	20.63	21.1	27.25	33.05	33.95
• At 60 Hz 460 V	kW	21.75	22.25	28.65	34.85	35.85
Cooling air requirement	m^3/s	1.96	1.96	2.6	2.6	2.6
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	77/79	77/79	77/79	78/80	78/80
Cable length, max.						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm	2200	2200	2800	2800	2800
• Height	mm	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600
Weight, approx.	kg	1731	1778	2408	2408	2408
Frame size		H	H	J	J	J

Note: The power data in hp units are based on the NEC/CEC standards for the North American market.

Information about line supply connections, motor connections and cabinet grounding can be found under **Cable cross-sections and connections**.

[1] Rated power of a typ. 6-pole standard induction motor based on I_L or I_H with 400 V 3 AC 50 Hz.

[2] Rated power of a typ. 6-pole standard induction motor based on I_L or I_H with 460 V 3 AC 60 Hz.

[3] The base load current I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

[4] The base load current I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

[5] If the drive closed-loop control is still to remain active when the line supply fails, then the equipment must be provided with an external 24 V DC supply.

[6] Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

[7] The specified power losses are the maximum values at 100 % utilization. The values are lower under normal operating conditions.

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Technical data

Line voltage 500 ... 690 V 3 AC 50 Hz		SINAMICS S150 Converter Cabinet Units					
		6SL3710-7LG28-5AA3	6SL3710-7LG31-0AA3	6SL3710-7LG31-2AA3	6SL3710-7LG31-5AA3	6SL3710-7LG31-8AA3	6SL3710-7LG32-2AA3
Type rating							
• For I_L (50 Hz 690 V) [1]	kW	**75**	**90**	**110**	**132**	**160**	**200**
• For I_H (50 Hz 690 V) [1]	kW	55	75	90	110	132	160
• For I_L (50 Hz 500 V) [1]	kW	55	55	75	90	110	132
• For I_H (50 Hz 500 V) [1]	kW	45	55	75	90	90	110
• For I_L (60 Hz 575 V) [2]	hp	75	75	100	150	150	200
• For I_H (60 Hz 575 V) [2]	hp	75	75	100	125	150	200
Output current							
• Rated current $I_{N\,A}$	A	85	100	120	150	175	215
• Base load current I_L [3]	A	80	95	115	142	170	208
• Base load current I_H [4]	A	76	89	107	134	157	192
• Max. current $I_{max\,A}$	A	120	142	172	213	255	312
Infeed/regenerative feedback current							
• Rated current $I_{N\,E}$	A	86	99	117	144	166	202
• Max. current $I_{max\,E}$	A	125	144	170	210	253	308
Current demand, max. [5]							
• 24 V DC aux. power supply	A	Internal	Internal	Internal	Internal	Internal	Internal
Pulse frequency [6]							
• Rated frequency	kHz	1.25	1.25	1.25	1.25	1.25	1.25
• Pulse frequency, max.							
- Without current derating	kHz	1.25	1.25	1.25	1.25	1.25	1.25
- With current derating	kHz	7.5	7.5	7.5	7.5	7.5	7.5
Power loss, max. [7]							
• At 50 Hz 690 V	kW	5.2	5.38	5.84	5.75	11.02	11.44
• At 60 Hz 575 V	kW	4.45	4.65	5.2	4.97	11.15	11.56
Cooling air requirement	m^3/s	0.58	0.58	0.58	0.58	1.19	1.19
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	71/73	71/73	71/73	71/73	75/77	75/77
Cable length, max.							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm	1400	1400	1400	1400	1600	1600
• Height	mm	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600
Weight, approx.	kg	708	708	708	708	892	892
Frame size		F	F	F	F	G	G

Note: The power data in hp units are based on the NEC/CEC standards for the North American market.

Information about line supply connections, motor connections and cabinet grounding can be found under **Cable cross-sections and connections**.

[1] Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 500 V or 690 V 3 AC 50 Hz.

[2] Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 575 V 3 AC 60 Hz.

[3] The base load current I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

[4] The base load current I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

[5] If the drive closed-loop control is still to remain active when the line supply fails, then the equipment must be provided with an external 24 V DC supply.

[6] Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

[7] The specified power loss represents the maximum value at 100 % utilization. The value is lower under normal operating conditions.

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Technical data

Line voltage 500 ... 690 V 3 AC 50 Hz		SINAMICS S150 Converter Cabinet Units					
		6SL3710-7LG32-6AA3	6SL3710-7LG33-3AA3	6SL3710-7LG34-1AA3	6SL3710-7LG34-7AA3	6SL3710-7LG35-8AA3	6SL3710-7LG37-4AA3
Type rating							
• For I_L (50 Hz 690 V) [1]	kW	**250**	**315**	**400**	**450**	**560**	**710**
• For I_H (50 Hz 690 V) [1]	kW	200	250	315	400	450	630
• For I_L (50 Hz 500 V) [1]	kW	160	200	250	315	400	500
• For I_H (50 Hz 500 V) [1]	kW	132	160	200	250	315	450
• For I_L (60 Hz 575 V) [2]	hp	250	300	400	450	600	700
• For I_H (60 Hz 575 V) [2]	hp	200	250	350	450	500	700
Output current							
• Rated current $I_{N\,A}$	A	260	330	410	465	575	735
• Base load current I_L [3]	A	250	320	400	452	560	710
• Base load current I_H [4]	A	233	280	367	416	514	657
• Max. current $I_{max\,A}$	A	375	480	600	678	840	1065
Infeed/regenerative feedback current							
• Rated current $I_{N\,E}$	A	242	304	375	424	522	665
• Max. current $I_{max\,E}$	A	370	465	619	700	862	1102
Current demand, max. [5]							
• 24 V DC aux. power supply	A	Internal	Internal	Internal	Internal	Internal	Internal
Pulse frequency [6]							
• Rated frequency	kHz	1.25	1.25	1.25	1.25	1.25	1.25
• Pulse frequency, max.							
- Without current derating	kHz	1.25	1.25	1.25	1.25	1.25	1.25
- With current derating	kHz	7.5	7.5	7.5	7.5	7.5	7.5
Power loss, max. [7]							
• At 50 Hz 690 V	kW	11.97	12.69	19.98	20.55	24.05	30.25
• At 60 Hz 575 V	kW	12.03	12.63	18.86	19.47	22.85	28.75
Cooling air requirement	m^3/s	1.19	1.19	1.96	1.96	1.96	2.6
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	75/77	75/77	77/79	77/79	77/79	77/79
Cable length, max.							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm	1600	1600	2200	2200	2200	2800
• Height	mm	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600
Weight, approx.	kg	892	892	1716	1716	1716	2300
Frame size		G	G	H	H	H	J

Note: The power data in hp units are based on the NEC/CEC standards for the North American market.

Information about line supply connections, motor connections and cabinet grounding can be found under **Cable cross-sections and connections**.

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 500 V or 690 V 3 AC 50 Hz.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 575 V 3 AC 60 Hz.

3) The base load current I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

5) If the drive closed-loop control is still to remain active when the line supply fails, then the equipment must be provided with an external 24 V DC supply.

6) Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

7) The specified power loss represents the maximum value at 100 % utilization. The value is lower under normal operating conditions.

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Technical data

Line voltage 500 ... 690 V 3 AC 50 Hz		SINAMICS S150 Converter Cabinet Units			
		6SL3710-7LG38-1AA3	6SL3710-7LG38-8AA3	6SL3710-7LG41-0AA3	6SL3710-7LG41-3AA3
Type rating					
• For I_L (50 Hz 690 V) [1]	kW	**800**	**900**	**1000**	**1200**
• For I_H (50 Hz 690 V) [1]	kW	710	800	900	1000
• For I_L (50 Hz 500 V) [1]	kW	560	630	710	900
• For I_H (50 Hz 500 V) [1]	kW	500	560	630	800
• For I_L (60 Hz 575 V) [2]	hp	800	900	1000	1250
• For I_H (60 Hz 575 V) [2]	hp	700	800	900	1000
Output current					
• Rated current $I_{N\,A}$	A	810	910	1025	1270
• Base load current I_L [3]	A	790	880	1000	1230
• Base load current I_H [4]	A	724	814	917	1136
• Max. current $I_{max\,A}$	A	1185	1320	1500	1845
Infeed/regenerative feedback current					
• Rated current $I_{N\,E}$	A	732	821	923	1142
• Max. current $I_{max\,E}$	A	1218	1367	1537	1905
Current demand, max. [5]					
• 24 V DC aux. power supply	A	Internal	Internal	Internal	Internal
Pulse frequency [6]					
• Rated frequency	kHz	1.25	1.25	1.25	1.25
• Pulse frequency, max.					
- Without current derating	kHz	1.25	1.25	1.25	1.25
- With current derating	kHz	7.5	7.5	7.5	7.5
Power loss, max. [7]					
• at 50 Hz 690 V	kW	34.45	34.65	36.15	42.25
• at 60 Hz 575 V	kW	32.75	32.85	34.25	39.25
Cooling air requirement	m^3/s	2.6	2.6	2.6	2.6
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	77/79	77/79	77/79	77/79
Cable length, max.					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm	2800	2800	2800	2800
• Height	mm	2000	2000	2000	2000
• Depth	mm	600	600	600	600
Weight, approx.	kg	2408	2408	2408	2408
Frame size		J	J	J	J

Note: The power data in hp units are based on the NEC/CEC standards for the North American market.

Information about line supply connections, motor connections and cabinet grounding can be found under **Cable cross-sections and connections**.

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 500 V or 690 V 3 AC 50 Hz.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 575 V 3 AC 60 Hz.

3) The base load current I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

5) If the drive closed-loop control is still to remain active when the line supply fails, then the equipment must be provided with an external 24 V DC supply.

6) Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

7) The specified power loss represents the maximum value at 100 % utilization. The value is lower under normal operating conditions.

Characteristic curves

Derating data

SINAMICS S150 Converter Cabinet Units and the associated system components are rated for an ambient temperature of 40 °C and installation altitudes up to 2000 m above sea level.

For ambient temperatures > 40 °C the output current must be reduced. Ambient temperatures above 50 °C are not permissible.

At installation altitudes > 2000 m above sea level, it must be taken into consideration that with increasing height, the air pressure decreases and therefore the air density. As a consequence, the cooling efficiency and the insulation capacity of the air also decrease.

Due to the reduced cooling efficiency, it is necessary, on one hand, to reduce the ambient temperature and on the other hand, to lower heat loss in the converter cabinet unit by reducing the output current, whereby ambient temperatures lower than 40 °C may be offset to compensate.

The following table lists the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already include a permitted compensation in respect of installation altitude and ambient temperatures < 40 °C temperature at the air intake of the converter cabinet unit.

The values apply under the precondition that it is a guaranteed that the cooling air, as specified in the technical data, flows through the units as a result of the cabinet arrangement.

As additional measure for installation altitudes from 2000 m up to 5000 m, an isolating transformer is required in order to reduce transient overvoltages according to EN 60664-1. For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

Degree of protection	Installation altitude above sea level	**Current derating factor** (as a % of the rated current) for an ambient/air intake temperature of						
	m	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
IP20, IP21, IP23, IP43	0 ... 2000	100 %	100 %	100 %	100 %	100 %	**93.3 %**	**86.7 %**
	2001 ... 2500	100 %	100 %	100 %	100 %	**96.3 %**		
	2501 ... 3000	100 %	100 %	100 %	**98.7 %**			
	3001 ... 3500	100 %	100 %	100 %				
	3501 ... 4000	100 %	100 %	**96.3 %**				
	4001 ... 4500	100 %	**97.5 %**					
	4501 ... 5000	**98.2 %**						
IP54	0 ... 2000	100 %	100 %	100 %	100 %	**93.3 %**	**86.7 %**	**80.0 %**
	2001 ... 2500	100 %	100 %	100 %	**96.3 %**	**89.8 %**		
	2501 ... 3000	100 %	100 %	**98.7 %**	**92.5 %**			
	3001 ... 3500	100 %	100 %	**94.7 %**				
	3501 ... 4000	100 %	**96.3 %**	**90.7 %**				
	4001 ... 4500	**97.5 %**	**92.1 %**					
	4501 ... 5000	**93.0 %**						

Current-derating factors for SINAMICS S150 as a function of the ambient/air intake temperature, the installation altitude and the degree of protection.

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Characteristic curves

Current derating as a function of pulse frequency

To reduce motor noise or to increase output frequency, the pulse frequency can be increased relative to the factory setting. When the pulse frequency is increased, the derating factor of the output current must be taken into account. This derating factor must be applied to the currents specified in the technical data.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

SINAMICS S150 Converter Cabinet Unit	Type rating at 400 V	Output current at 2 kHz	**Derating factor** at the pulse frequency				
6SL3710-...	kW	A	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
380 ... 480 V 3 AC							
7LE32-1AA3	110	210	95 %	82 %	74 %	54 %	50 %
7LE32-6AA3	132	260	95 %	83 %	74 %	54 %	50 %
7LE33-1AA3	160	310	97 %	88 %	78 %	54 %	50 %
7LE33-8AA3	200	380	96 %	87 %	77 %	54 %	50 %
7LE35-0AA3	250	490	94 %	78 %	71 %	53 %	50 %

Derating factor of the output current as a function of the pulse frequency for units with a rated pulse frequency of 2 kHz

SINAMICS S150 Converter Cabinet Unit	Type rating at 400 V or 690 V	Output current at 1.25 kHz	**Derating factor** at the pulse frequency				
6SL3710-...	kW	A	2.0 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz
380 ... 480 V 3 AC							
7LE36-1AA3	315	605	83 %	72 %	64 %	60 %	40 %
7LE37-5AA3	400	745	83 %	72 %	64 %	60 %	40 %
7LE38-4AA3	450	840	87 %	79 %	64 %	55 %	40 %
7LE41-0AA3	560	985	92 %	87 %	70 %	60 %	50 %
7LE41-2AA3	710	1260	92 %	87 %	70 %	60 %	50 %
7LE41-4AA3	800	1405	97 %	95 %	74 %	60 %	50 %
500 ... 690 V 3 AC							
7LG28-5AA3	75	85	93 %	89 %	71 %	60 %	40 %
7LG31-0AA3	90	100	92 %	88 %	71 %	60 %	40 %
7LG31-2AA3	110	120	92 %	88 %	71 %	60 %	40 %
7LG31-5AA3	132	150	90 %	84 %	66 %	55 %	35 %
7LG31-8AA3	160	175	92 %	87 %	70 %	60 %	40 %
7LG32-2AA3	200	215	92 %	87 %	70 %	60 %	40 %
7LG32-6AA3	250	260	92 %	88 %	71 %	60 %	40 %
7LG33-3AA3	315	330	89 %	82 %	65 %	55 %	40 %
7LG34-1AA3	400	410	89 %	82 %	65 %	55 %	35 %
7LG34-7AA3	450	465	92 %	87 %	67 %	55 %	35 %
7LG35-8AA3	560	575	91 %	85 %	64 %	50 %	35 %
7LG37-4AA3	710	735	87 %	79 %	64 %	55 %	35 %
7LG38-1AA3	800	810	97 %	95 %	71 %	55 %	35 %
7LG38-8AA3	900	910	92 %	87 %	67 %	55 %	33 %
7LG41-0AA3	1000	1025	91 %	86 %	64 %	50 %	30 %
7LG41-3AA3	1200	1270	87 %	79 %	55 %	40 %	25 %

Derating factor of the output current as a function of the pulse frequency for units with a rated pulse frequency of 1.25 kHz

The following table lists the maximum achievable output frequency as a function of the pulse frequency:

Pulse frequency	Max. achievable output frequency
1.25 kHz	100 Hz
2.00 kHz	160 Hz
2.50 kHz	200 Hz
≥ 4.00 kHz	300 Hz

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Characteristic curves

Overload capability

The SINAMICS S150 Converter Cabinet Units are equipped with an overload reserve to deal with breakaway torques, for example. If larger surge loads occur, this must be taken into account when configuring. In drives with overload requirements, the appropriate base load current must, therefore, be used as a basis for the required load.

The criterion for overload is that the drive is operated with its base load current before and after the overload occurs on the basis of a duty cycle duration of 300 s.

For short, repeating load cycles with significant load fluctuations within the load cycle, the appropriate sections in the SINAMICS Low Voltage Engineering Manual must be observed (as PDF file on the CD-ROM provided with the catalog).

The base load current for a low overload I_L is the basis for a duty cycle of 110 % for 60 s or 150 % for 10 s.

Low overload

The base load current for a high overload I_H is the basis for a duty cycle of 150 % for 60 s or 160 % for 10 s.

High overload

Selection and ordering data

Type rating at 400 V or 690 V	Rated output current I_N	**SINAMICS S150 Converter Cabinet Unit**
kW	A	Order No.
Line voltage 380 ... 480 V 3 AC		
110	210	**6SL3710-7LE32-1AA3**
132	260	**6SL3710-7LE32-6AA3**
160	310	**6SL3710-7LE33-1AA3**
200	380	**6SL3710-7LE33-8AA3**
250	490	**6SL3710-7LE35-0AA3**
315	605	**6SL3710-7LE36-1AA3**
400	745	**6SL3710-7LE37-5AA3**
450	840	**6SL3710-7LE38-4AA3**
560	985	**6SL3710-7LE41-0AA3**
710	1260	**6SL3710-7LE41-2AA3**
800	1405	**6SL3710-7LE41-4AA3**
Line voltage 500 ... 690 V 3 AC		
75	85	**6SL3710-7LG28-5AA3**
90	100	**6SL3710-7LG31-0AA3**
110	120	**6SL3710-7LG31-2AA3**
132	150	**6SL3710-7LG31-5AA3**
160	175	**6SL3710-7LG31-8AA3**
200	215	**6SL3710-7LG32-2AA3**
250	260	**6SL3710-7LG32-6AA3**
315	330	**6SL3710-7LG33-3AA3**
400	410	**6SL3710-7LG34-1AA3**
450	465	**6SL3710-7LG34-7AA3**
560	575	**6SL3710-7LG35-8AA3**
710	735	**6SL3710-7LG37-4AA3**
800	810	**6SL3710-7LG38-1AA3**
900	910	**6SL3710-7LG38-8AA3**
1000	1025	**6SL3710-7LG41-0AA3**
1200	1270	**6SL3710-7LG41-3AA3**

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Options

When ordering a drive converter with options, add the suffix "**-Z**" to the order number and then state the order code(s) for the desired option(s) after the suffix.

Example:
6SL3710-7LE32-1AA3-Z
M07+D60+...

See also ordering examples.

Available options	Order code
Input side	
Use in the first environment according to EN 61800-3, Category C2 (TN-TT line supplies with grounded neutral point)	**L00**
Infeed module one level lower	**L04**
Main control switch incl. fuses/circuit breakers	**L26**
EMC shield bus (cable connection from below) [1]	**M70**
Output side	
dv/dt filter compact plus Voltage Peak Limiter	**L07**
Motor reactor	**L08**
dv/dt filter plus Voltage Peak Limiter	**L10**
Sine-wave filter (only for the voltage range 380 to 480 V, up to 200 kW)	**L15**
EMC shield bus (cable connection from below) [1]	**M70**
Motor protection and safety functions	
EMERGENCY OFF pushbutton installed in the cabinet door	**L45**
EMERGENCY OFF Stop Category 0, 230 V AC or 24 V DC	**L57**
EMERGENCY STOP Stop Category 1, 230 V AC	**L59**
EMERGENCY STOP Stop Category 1, 24 V DC	**L60**
Thermistor motor protection unit (alarm)	**L83**
Thermistor motor protection unit (trip)	**L84**
Pt100 evaluation unit	**L86**
Insulation monitoring	**L87**
Additional touch protection	**M60**
Enhanced degree of protection	
IP21 degree of protection	**M21**
IP23 degree of protection	**M23**
IP43 degree of protection	**M43**
IP54 degree of protection	**M54**
Mechanical options	
Base 100 mm high, RAL 7022	**M06**
Cable-marshalling space 200 mm high, RAL 7035	**M07**
Line connection from above	**M13**
Motor connection from above	**M78**
Crane transport assembly for cabinets (top-mounted)	**M90**
Other options	
CBC10 Communication Board	**G20**
CBE20 Communication Board	**G33**
Customer terminal block TM31	**G60**
Additional customer terminal block TM31	**G61**
Safety license for 1 axis	**K01**
SMC10 Sensor Module Cabinet-Mounted	**K46**
SMC20 Sensor Module Cabinet-Mounted	**K48**
SMC30 Sensor Module Cabinet-Mounted	**K50**
VSM10 Voltage Sensing Module	**K51**
Terminal module for controlling the Safe Torque Off and Safe Stop 1 safety functions	**K82**

Available options	Order code
TM54F Terminal Module	**K87**
Safe Brake Adapter SBA, 230 V AC	**K88**
Safe Brake Adapter SBA, 24 V DC	**K89**
CU320-2 PN Control Unit	**K95**
Connection for external auxiliary equipment	**L19**
Cabinet illumination with service socket	**L50**
Cabinet anti-condensation heating	**L55**
25/125 kW braking unit for line voltages of 380 ... 480 V (110 ... 132 kW) and 660 ... 690 V (75 ... 132 kW)	**L61**
50/250 kW braking unit for line voltages of 380 ... 480 V (160 ... 800 kW) and 660 ... 690 V (160 ... 1200 kW)	**L62**
25/125 kW braking unit for line voltages of 500 ... 600 V (75 ... 132 kW)	**L64**
50/250 kW braking unit for line voltages of 500 ... 600 V (160 ... 1200 kW)	**L65**
Special cabinet paint finish [2]	**Y09**
Documentation (standard: English/German)	
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	**D02**
Customer documentation as hard copy	**D04**
Preliminary version of customer documentation	**D14**
Documentation language: English/French	**D58**
Documentation language: English/Spanish	**D60**
Documentation language: English/Italian	**D80**
Rating plate data (standard: English/German)	
Rating plate data in English/French	**T58**
Rating plate data in English/Spanish	**T60**
Rating plate data in English/Italian	**T80**
Options specific to the chemical industry	
NAMUR terminal block	**B00**
Protective separation for 24 V supply (PELV)	**B02**
Outgoing feeder for external auxiliaries (uncontrolled)	**B03**
Converter acceptance inspection in presence of customer	
Visual acceptance	**F03**
Function test without connected motor	**F71**
Function test with test bay motor (no load)	**F75**
Insulation test	**F77**
Customer-specific acceptance inspections (on request)	**F97**
Options specific to the shipbuilding industry	
Marine version	**M66**
Individual certificate from Germanischer Lloyd (GL)	**E11**
Individual certificate from Lloyds Register (LR)	**E21**
Individual certificate from Bureau Veritas (BV)	**E31**
Individual certificate from Det Norske Veritas (DNV)	**E51**
Individual certificate from American Bureau of Shipping (ABS)	**E61**
Individual certificate from Chinese Certification Society (CCS)	**E71**

[1] This option is listed for the input- and output-side options, but is only required once.

[2] The order code **Y..** requires data in plain text.

Options

Option selection matrix

Certain options can mutually exclude one another (options that are not involved are not shown).

✓	Possible combination
–	Combination not possible

Electrical options

	L07	L08	L10	L15	L57	L59	L60	L61/ L64	L62/ L65	L87	K82	M78
L07		–	–	–	✓	✓	✓	✓	✓	✓	✓	–
L08	–		–	–	✓	✓	✓	✓	✓	✓	✓	–
L10	–	–		–	✓	✓	✓	✓	✓	✓	✓	–
L15	–	–	–		✓	✓	✓	✓	✓	✓	✓	–
L57	✓	✓	✓	✓		–	–	✓	✓	✓	✓	✓
L59	✓	✓	✓	✓	–		–	✓	✓	✓	✓	✓
L60	✓	✓	✓	✓	–	–		✓	✓	✓	✓	✓
L61/L64	✓	✓	✓	✓	✓	✓	✓		–	✓	✓	✓
L62/L65	✓	✓	✓	✓	✓	✓	✓	–		✓	✓	✓
L87	✓	✓	✓	✓	✓	✓	✓	✓	✓		– [1]	✓
K82	✓	✓	✓	✓	✓	✓	✓	✓	✓	– [1]		✓
M78	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	

Mechanical/electrical options

	M06	M07	M13	M21	M23	M43	M54	M60	M66	M70	M78
M06		–	✓	✓	✓	✓	✓	✓	✓	✓	✓
M07	–		✓	✓	✓	✓	✓	✓	✓	✓	✓
M13	✓	✓		–	✓	✓	✓	–	✓	– [2]	✓
M21	✓	✓	–		–	–	–	– [3]	–	✓	–
M23	✓	✓	✓	–		–	–	–	–	✓	✓
M43	✓	✓	✓	–	–		–	–	–	✓	✓
M54	✓	✓	✓	–	–	–		–	✓	✓	✓
M60	✓	✓	–	– [3]	–	–	–		✓	✓	–
M66	✓	✓	✓	–	–	–	✓	✓		✓	–
M70	✓	✓	– [2]	✓	✓	✓	✓	✓	✓		– [2]
M78	✓	✓	✓	–	✓	✓	✓	–	–	– [2]	

Other options

	G20	G33	K46	K48	K50	K51
G20		–	✓	✓	✓	✓
G33	–		✓	✓	✓	✓
K46	✓	✓		–	–	–
K48	✓	✓	–		–	–
K50	✓	✓	–	–		–
K51	✓	✓	–	–	–	

Rating plate data

	T58	T60	T80
T58		–	–
T60	–		–
T80	–	–	

[1] A combination of **L87** and **K82** is available on request.

[2] If the line connection (option **M13**) and the motor connection (option **M78**) are from above, the EMC shield bus is not required in the lower cabinet area.

[3] Can only be selected for converters in the voltage range 400 V to 250 kW and 690 V to 315 kW. The **M60** option is fitted as standard for higher outputs.

Options

Ordering examples

Example 1

Task:
A drive system is required for a vehicle test stand to perform exhaust gas analysis which can simulate driving profiles and cycles as encountered in everyday traffic situations. This means for the drive system that the dynamometer must be operated both in the motoring as well as regenerating modes.

A drive with regenerative feedback into the line supply is required as regenerative operation is the predominant operating mode and dynamic switching operations are required.

The max. regenerative power is 200 kW. The drive converter must have degree of protection IP54 as a result of the environmental conditions. An installation altitude of < 1000 m and 45 °C as the maximum ambient temperature can be assumed. The windings must be equipped with Pt100 resistance thermometers and monitored by the drive converter for alarm and trip. A switch disconnector must be provided to disconnect the converter from the 400 V power supply. In addition, the cabinet is to have a special paint finish in RAL 3002.

Solution:
Taking into account the derating factors for degree of protection IP54 and the increased ambient temperature of 45 °C, a converter with a minimum power rating of 223 kW must be configured.
A converter with a power rating of at least 250 kW and options **M54** (degree of protection IP54), **L26** (main control switch including fuses), **L86** (Pt100 evaluation unit) and **Y09** (special paint finish) is selected.

The ordering data are as follows:
6SL3710-7LE35-0AA3-Z
M54 +L26+L86+Y09
Cabinet color RAL 3002

Example 2

Task:
A drive system is required for a conveyor belt in a brown-coal open-cast mine which is capable of both motor and generator operation. Since the conveyor belt must be capable of starting after a fault when loaded with bulk material, and it is possible for peak loads to occur where 1.5 times the power is required for up to 60 s, the drive system must be designed according to the overload requirements of such a case. The drive converter is installed in a climate-controlled container as a result of the environmental conditions typical of an open-cast mine. The installation altitude is 320 m above sea level and the maximum ambient temperature in the container is 35 °C. The drive is supplied through a converter transformer from the medium-voltage network. The drive is operated from an ungrounded line supply and must have insulation monitoring. A motor with separately-driven fan is selected here as the motor is subject to a high load torque when starting and in the lower range. The fan supply voltage is 690 V and must be drawn from the drive converter.

The required motor power is 420 kW.

Solution:
Since the converter is installed in an air-conditioned container, it can be designed with IP20 degree of protection. The 35 °C ambient temperature does not necessitate any additional derating. However, due to the specified overload conditions, the base load current I_H (for high overload) must be applied. This results in a power of approx. 520 kW for the drive converter. The converter with Order No. 6SL3710-7LG35-8AA3 must be selected.

Option **L87** (insulation monitoring) must be selected for insulation monitoring.

Option **L19** (connection for external auxiliaries) must be selected for the controlled outgoing feeder to supply the separately-driven fan.

The ordering data are as follows:
6SL3710-7LG35-8AA3-Z
L19+L87

Options

B00, B02, B03
Options compliant with NAMUR requirements

List of impermissible combinations with other options:

The following restrictions and exclusions applicable to the NAMUR terminal block **B00** in relation to other available options must be taken into account.

Not permissible with options	Reason
L45, L57, L59, L60	An EMERGENCY OFF Stop Category 0 is already provided in the NAMUR version. The forced line supply disconnection is connected at terminal -X2: 17, 18.
L83, L84	The **B00** option already provides a PTC thermistor evaluation unit as standard (trip).
L19	Alternatively, option **B03** can be selected. This means that a reduced scope is available for external auxiliaries.
L87	The insulation monitor monitors the complete electrically coupled network. An insulation monitor must therefore be provided on site.

For options **L50, L55, L86**, the connection is made as described in the standard. These options are not wired to the NAMUR terminal block.

B00
NAMUR terminal block

The terminal block has been configured in accordance with the requirements and guidelines of the Standards Working Group for Instrumentation and Control in the Chemicals Industry (NAMUR Recommendation NE37), i.e. certain functions of the device are assigned to specified terminals. The inputs and outputs connected to the terminals fulfill PELV requirements (protective extra-low voltage) with protective separation.

The terminal block and associated functions have been reduced to the necessary minimum. Unlike the NAMUR recommendation, optional terminals are not available.

Terminal -X2:	Meaning	Default	Remarks
10	DI	ON (dynamic)/ ON/OFF (static)	The effective mode can be encoded using a wire jumper at terminal -400: 9; 10
11	DI	OFF (dynamic)	
12	DI	Faster	
13	DI	Slower	
14	DI	RESET	
15	DI	Interlock	
16	DI	Counterclockwise	0 signal for CW rotating field 1 signal for CCW rotating field
17, 18		Supply disconnection	EMERGENCY OFF circuit
30, 31		Ready for operation	Relay output (NO contact)
32, 33		Motor is turning	Relay output (NO contact)
34	DO (NO)	Fault	Relay output (changeover contact)
35	DO (COM)		
36	DO (NC)		
50, 51	AI 0/4 ... 20 mA	Speed setpoint	
60, 61	AO 0/4 ... 20 mA	Motor frequency	
62, 63	AO 0/4 ... 20 mA	Motor current	Motor current is default setting; can be reparameterized for other variables

The 24 V supply is provided on the plant side via terminals -X2:1-3 (fused in the converter with 1 A). It must be ensured that the PELV safety requirements are fulfilled (protective extra-low voltage with protective separation).

Terminal -X2:	Meaning	
1	M	Reference conductor
2	P24	24 V DC supply
3	P24	24 V DC outgoing feeder

For temperature monitoring of explosion-proof motors, option **B00** includes a PTC thermistor.
Exceeding the limit value leads to shutdown. The associated PTC sensor is connected to terminal -X3: 90, 91.

Terminal -X3:	Meaning	
90, 91	AI	Connection of PTC sensor

Options

B02
Protective separation for 24 V supply (PELV)

If no protective separation for 24 V supply (PELV) is available at the customer site, this option is used to provide a second power supply to guarantee compliance with PELV. (Terminal assignments as for option **B00**, 24 V supply at terminals -X1:1, 2, 3 is not required)

Notice: The option **B02** must always be combined with **B00**.

B03
Outgoing feeder for external auxiliaries (uncontrolled)

If a motor fan is to be supplied with power from the plant, option **B03** provides an uncontrolled external outgoing feeder with a 10 A fuse. As soon as the supply voltage is present at the converter input, a voltage equaling the converter input voltage ($U = U_{line}$) is also applied at these terminals. This must be taken into consideration when separately driven fans are configured.

Terminal -X1:	Meaning
1, 2, 3, PE	Outgoing feeder for external auxiliary equipment

Notice: Option **B03** must always be combined with **B00**.

D02
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format

Option **D02** can be used to order documents such as circuit diagrams, terminal diagrams, layout diagrams, and dimension drawings in DXF format, e.g. for further processing in AutoCAD systems.

D04
Customer documentation as hard copy

Equipment documentation is supplied electronically on CD-ROM as standard. If the customer also requires a hard copy of the documentation and selects option **D04**, the following documents will be shipped in a folder with the drive converter:

- Operating instructions
- Circuit diagram
- Terminal diagram
- Layout diagram
- Dimension drawing
- Spare parts list
- Test certificate

Regardless of whether option **D04** is selected, a hard copy of the safety and transportation guidelines, a check list and a registration form is always supplied.

D14
Preliminary version of customer documentation

If documents such as circuit diagrams, terminal diagrams, layout diagrams and dimension drawings are required in advance for the purpose of system engineering (integration of drive into higher-level systems, interface definition, installation, building planning, etc.), it is possible to order a draft copy of the documentation when ordering the converter cabinet units. These documents are then supplied electronically a few working days following receipt of the order. If the order includes options that fall outside the scope of standard delivery, these will not be covered by the documentation due to the obvious time constraints.

Documentation relating to the order is sent to the buyer by e-mail. The recipient's e-mail address must be specified with the order for this purpose. In the e-mail, the recipient will also receive a link (Internet address) for downloading general, non-order-specific documentation such as the Operating Instructions, Equipment Manual and Commissioning Instructions.

D58, D60, D80
Documentation language

Option	Language
D58	English/French
D60	English/Spanish
D80	English/Italian

E11 to E71
Individual certification

The individual certification of the converter by the relevant certification body contains the expansions described in option **M66**.

- **E11** Individual certificate from Germanischer Lloyd (GL)
- **E21** Individual certificate from Lloyds Register (LR)
- **E31** Individual certificate from Bureau Veritas (BV)
- **E51** Individual certificate from Det Norske Veritas (DNV)
- **E61** Individual certificate from American Bureau of Shipping (ABS)
- **E71** Individual certificate from Chinese Classification Society (CCS)

Note: Several individual certificates can be combined.

Options

F03, F71, F75, F77, F97
Converter acceptance inspections in the presence of the customer

Option	Description
F03	**Visual acceptance** The inspection includes the following: • Check of degree of protection • Check of equipment (components) • Check of equipment identifiers • Check of clearance and creepage distances • Check of cables • Check of customer documentation • Submission of the acceptance report All the above checks are performed with the converter isolated from the power supply.
F71	**Function test without connected motor** The inspection includes the following: • Visual inspection as described for option **F03** • Check of power supply • Check of protective and monitoring devices (simulation) • Check of fans • Pre-charging test • Function test without connected motor • Submission of the acceptance report After the visual inspection with the converter switched off, the converter is connected to rated voltage. No current at the converter output end.
F75	**Function test with test bay motor (no load)** The inspection includes the following: • Visual inspection as described for option **F03** • Check of power supply • Check of protective and monitoring devices (simulation) • Check of fans • Pre-charging test • Function test with test bay motor (no load) • Submission of the acceptance report After the visual inspection with the converter switched off, the converter is connected to rated voltage. A small current flows at the converter's output in order to operate the test bay motor (no load).
F77	**Insulation test** The inspection includes the following: • High-voltage test • Measurement of insulation resistance
F97	**Customer-specific acceptance inspections (on request)** If acceptance inspections that are not covered by the options **F03**, **F71**, **F75** or **F77** are required, then customer-specific acceptance inspections/supplementary tests can be ordered using order code **F97** on request and following technical clarification.

G20
CBC10 Communication Board

The CBC10 Communication Board is used to interface the CU320-2 Control Unit and thus the SINAMICS S150 to the CAN (Controller Area Network) protocol. The board's driver software fulfills the standards of the following CANopen specification of the CiA organization (CAN in Automation):

Communication profiles in accordance with DS 301:

- Drive profile in accordance with DSP 402 (in this case Profile Velocity Mode)
- EDS (Electronic Data Sheet) in accordance with DSP 306
- Operational status signaling in accordance with DSP 305

The CBC10 Communication Board plugs into the option slot on the CU320-2 Control Unit. The CAN interface on the CBC10 has 2 SUB-D connections for input and output.

Description of the CBC10 Communication Board → Chapter 2.

G33
CBE20 Communication Board

The CBE20 Communication Board can be used to connect the SINAMICS S150 to a PROFINET IO network via a CU320-2 Control Unit. The CBE Communication Board plugs into the option slot on the CU320-2 Control Unit.

Description of the CBE20 Communication Board → Chapter 2.

G60
Customer terminal block TM31

The TM31 Terminal Module is used to expand the customer terminal.

The following additional interfaces are available for this:

- 8 digital inputs
- 4 bidirectional digital inputs/outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor input (KTY84-130/PTC)
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC supply connector
- 1 PE/protective conductor connection

To simplify configuration and commissioning of the drive, the optional TM31 Terminal Module is already preset with various factory settings, which can then be selected when commissioning the system.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

G61
Additional customer terminal block TM31

With option **G61**, the number of digital inputs/outputs, as well as the number of analog inputs/outputs in the drive system can be expanded using a second TM31 Terminal Module (in addition to the TM31 Terminal Module that can be selected using option **G60**).

Note: Option **G61** requires option **G60**!

Options

K01
Safety license for 1 axis

The Safety Integrated Basic Functions do not require a license. However, on the other hand, for Safety Integrated Extended Functions, a license is required for each axis equipped with safety functions. It is irrelevant which safety functions are used and how many. Option **K01** contains the license for 1 axis.

Subsequent licensing is possible in the Internet via the WEB License Manager by generating a license key: www.siemens.com/automation/license

K46
SMC10 Sensor Module Cabinet-Mounted

The SMC10 Sensor Module Cabinet-Mounted can be used to simultaneously sense the speed and the rotor position angle. The signals emitted by the resolver are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.

The following encoder signals can be evaluated:

- 2-pole resolver
- Multipole resolver

The motor temperature can also be detected using KTY84-130 or PTC thermistors.

Description of the SMC10 Sensor Module Cabinet-Mounted → Chapter 2.

K48
SMC20 Sensor Module Cabinet-Mounted

The SMC20 Sensor Module Cabinet-Mounted can be used to simultaneously sense the speed and position. The signals emitted by the incremental encoder are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.

The following encoder signals can be evaluated:

- Incremental encoder sin/cos 1 V_{pp}
- EnDat absolute encoder
- SSI encoder with incremental signals sin/cos 1 V_{pp} (firmware version 2.4 and later)

The motor temperature can also be detected using KTY84-130 or PTC/Pt100 thermistors.

Description of the SMC20 Sensor Module Cabinet-Mounted → Chapter 2.

K50
SMC30 Sensor Module Cabinet-Mounted

The SMC30 Sensor Module Cabinet-Mounted can be used to evaluate the encoders of motors without a DRIVE-CLiQ interface. External encoders can also be connected via the SMC30.

The following encoder signals can be evaluated:

- Incremental encoders TTL/HTL with/without open-circuit detection (open-circuit detection is only available with bipolar signals)
- SSI encoder with TTL/HTL incremental signals
- SSI encoder without incremental signals

The motor temperature can also be detected using KTY84-130 or PTC thermistors.

Description of the SMC30 Sensor Module Cabinet-Mounted → Chapter 2.

K51
VSM10 Voltage Sensing Module

The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following function can be implemented:

- Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function)

Description of the VSM10 Voltage Sensing Module → Chapter 2.

K82
Terminal module for controlling the Safe Torque Off and Safe Stop 1 safety functions

The terminal module controls the Basic Safety Functions Safe Torque Off (STO) and Safe Stop 1 (SS1) (time-controlled) over a wide voltage range from 24 V to 240 V DC/AC (terminology as defined in draft IEC 61800-5-2).

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the components (Control Unit and Power Module), satisfy the requirements of EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (previously EN 954-1) for Performance Level (PL) d and IEC 61508 SIL 2.

With option **K82**, the requirements specified in EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (previously EN 954-1) for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

The Safety Integrated functions using option **K82** are only available in conjunction with certified components and software versions.

The Safety Integrated functions of SINAMICS are generally certified by independent institutes. An up-to-date list of certified components is available on request from your local Siemens office.

K87
TM54F Terminal Module

The TM54F Terminal Module is a terminal expansion module with safe digital inputs and outputs to control the Safety Integrated functions.

The TM54F must be connected directly to a Control Unit via DRIVE-CLiQ. Each Control Unit can be precisely assigned to one TM54F.

The TM54F has 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output consists of one 24 V DC switching output, an output switching to ground and one digital input to check the switching state. A fail-safe digital input consists of two digital inputs.

K88
Safe Brake Adapter SBA, 230 V AC

The Safe Brake Control (SBC) is a safety function, which is used in safety-relevant applications, for example in presses or rolling mills. In the no-current state, the brake acts on the drive motor using spring force. The brake is released when current flows in it (low active).

The Safe Brake Adapter, 230 V AC is factory installed in the cabinet unit. A source of power is connected to terminal -X12 on the Safe Brake Adapter. For control, a connection is established between the Safe Brake Adapter and the Control Interface Module in the factory using a cable harness.

On the plant side, to control the brake, a connection must be established between terminal -X14 on the Safe Brake Adapter and the brake.

Options

K89
Safe Brake Adapter SBA, 24 V DC

The Safe Brake Control (SBC) is a safety function, which is used in safety-relevant applications, for example in presses or rolling mills. In the no-current state, the brake acts on the drive motor using spring force. The brake is released when current flows in it (low active).

The Safe Brake Adapter, 24 V DC is factory installed in the cabinet unit. A source of power is connected to terminal -X13 on the Safe Brake Adapter. For control, a connection is established between the Safe Brake Adapter and the Control Interface Module in the factory using a cable harness.

On the plant side, to control the brake, a connection must be established between terminal -X14 on the Safe Brake Adapter and the brake.

K95
CU320-2 PN (PROFINET) Control Unit

The converter is supplied with a CU320-2 PN Control Unit (PROFINET) instead of the CU320-2 DP Control Unit (PROFIBUS) included as standard. Detailed information on this can be found for SINAMICS S120 Chassis Format Units, Control Units.

L00
Use in the first environment according to EN 61800-3, Category C2 (TN/TT supply systems with grounded neutral point)

In order to limit interference emission, the converter includes as standard a radio interference suppression filter according to the EMC product standard EN 61800-3, Category C3 (use in the industrial environment or in the second environment).

By using the optionally available line filter (option **L00**), up to a motor cable length of 300 m on grounded line supplies, the converters are suitable for use according to Category C2 (residential area or first environment).

However, complying with the limit values in the standard means that all of the relevant installation specifications regarding grounding and shielding must be strictly observed.

Notes on this are provided in the SINAMICS Low Voltage Engineering Manual as well as in the appropriate operating instructions.

L04
Infeed module one level lower

With this option, an infeed (Active Line Module/Active Interface Module) rated one power level lower than the Motor Module (inverter) is used.

The option is suitable for the following applications, for example:

- If the Motor Module is operated with pulse frequencies greater than the rated pulse frequency, thereby reducing the output power (current derating as a function of the pulse frequency).
- If the rated power is required in regenerative mode and the system losses are covered by the Motor Module.
- With motors that have a higher efficiency and/or a lower power factor compared to typical standard induction motors.
- The maximum current of the Motor Module is requested below the maximum power of the unit, e.g. drives with a high breakaway torque.

When using option **L04**, the following restrictions must always be taken into consideration:

- The rated output current of the Motor Module is only available as long as the infeed (Active Line Module) is not loaded with the rated power.
- For line undervoltage conditions, the output power is reduced linearly with the line voltage.
- The unit should be operated with a line power factor cos $\varphi = 1$ (this corresponds to the factory setting) and should only provide the active power. It does not make sense to additionally compensate the reactive power at the line supply.

Option **L04** is available for the following cabinet units:

SINAMICS S150 Converter Cabinet Unit	Type rating at 400 V	**Permissible currents**		
		Output	Input	
			Standard	With option **L04**
6SL3710-...	kW	A	A	A
Line voltage 380 ... 480 V 3 AC				
7LE33-1AA3	160	310	310	260
7LE35-0AA3	250	490	490	380
7LE36-1AA3	315	605	605	490
7LE37-5AA3	400	745	745	605
7LE41-0AA3	560	985	985	840

Options

L07
dv/dt filter compact plus Voltage Peak Limiter

dv/dt filter compact plus VPL (**V**oltage **P**eak **L**imiter) limits the voltage rate-of-rise dv/dt to values < 1600 V/µs, and the typical voltage peaks to the following values according to the limit value curve A according to IEC 60034-25: 2007:

- < 1150 V at U_{line} < 575 V
- < 1400 V at 660 V < U_{line} < 690 V

The dv/dt filter compact plus VPL functionally comprises two components, which are mechanically supplied as a compact unit, the dv/dt reactor and the voltage limiting network VPL, which cuts off voltage peaks and feeds back the energy into the DC link.

It is so compact that it can be completely integrated into the cabinet, even for high power ratings. An additional cabinet is not required.

By using a dv/dt filter compact plus VPL, standard motors with standard insulation and without insulated bearings can be used with supply voltages up to 690 V in converter operation.

dv/dt filter compact plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 100 m (e.g. Protodur NYCWY)
- Unshielded cables 150 m (e.g. Protodur NYY)

For longer cable lengths (> 100 m shielded, >150 m unshielded) use the dv/dt filter plus VPL (option **L10**).

Notice:

- The max. permissible cable length between the dv/dt filter and converter is 5 m.
- Operation with output frequencies < 10 Hz is permissible for max. 5 min.

Also observe the appropriate notes in the SINAMICS Low Voltage Engineering Manual (as PDF on the CD-ROM provided with the catalog).

Note:
Option **L07** cannot be combined with the following options:

- **L08** (motor reactor)
- **L10** (dv/dt filter plus VPL)
- **L15** (sine-wave filter)
- **M78** (motor connection from above)

L08
Motor reactor

Motor reactors reduce the voltage load on the motor windings by reducing the voltage gradients on the motor terminals generated when the converter is used. At the same time, the capacitive charge/discharge currents that place an additional load on the converter output when long motor cables are used are reduced.

The maximum permissible output frequency when a motor reactor is used is 150 Hz.

For converter cabinet units with power units connected in parallel, a motor reactor is available on request.

Option **L08** cannot be combined with option **M78** (motor connection from above).

L10
dv/dt filter plus Voltage Peak Limiter

dv/dt filter plus VPL (Voltage Peak Limiter) limits the voltage rate-of-rise dv/dt to values < 500 V/µs, and the typical voltage peaks to the following values according to the limit value curve to IEC/TS 60034-17: 2006:

- < 1000 V at U_{line} < 575 V
- < 1250 V at 660 V < U_{line} < 690 V

The dv/dt filter plus VPL functionally comprises two components, the dv/dt reactor and the voltage limiting network VPL, which cuts off voltage peaks and feeds back the energy into the DC link.

Depending on the converter power, option **L10** can be accommodated in the converter cabinet unit or an additional cabinet is required with a width of 400 mm or 600 mm.

Voltage range	Installation of the dv/dt filter plus VPL		
	in the converter (without supplementary cabinet)	in the supplementary cabinet 400 mm wide	in the supplementary cabinet 600 mm wide
380 ... 480 V	110 ... 250 kW	315 ... 450 kW	560 ... 800 kW
500 ... 690 V	75 ... 315 kW	400 ... 560 kW	710 ... 1200 kW

By using a dv/dt filter plus VPL, standard motors with standard insulation and without insulated bearings can be used with supply voltages up to 690 V in converter operation.

dv/dt filter plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 300 m (e.g. Protodur NYCWY)
- Unshielded cables 450 m (e.g. Protodur NYY)

For cable lengths < 100 m shielded or < 150 m unshielded, the dv/dt filter compact plus VPL (option **L07**) can be advantageously used.

When using dv/dt filters, restrictions regarding permissible pulse and output frequencies must be observed.

The corresponding notes are provided in the SINAMICS Low Voltage Engineering Manual (as PDF on the CD-ROM provided with the catalog).

Note:
Parts of option **L10** do not have nickel-plated copper busbars.

Option **L10** cannot be combined with the following options:

- **L07** (dv/dt filter compact plus VPL)
- **L08** (motor reactor)
- **L15** (sine-wave filter)
- **L08** (motor connection from above)

Options

L15
Sine-wave filter

Sine-wave filters are available up to a converter power rating of 250 kW (380 V to 480 V) or up to 132 kW (500 V to 600 V). The sine-wave filter at the converter output supplies almost perfect sinusoidal voltages at the motor so that standard motors can be used without special cables or power derating. Standard cables can be used. The max. permissible motor cable length is limited to 300 m.

Note: In conjunction with the option **L15**, the pulse frequency of the converter must be increased. This reduces the power available at the drive converter output (derating factor 0.88). The modulation depth of the output voltage decreases to approx. 85 % (380 V to 480 V) or approx. 81 % (500 V to 600 V). The maximum output frequency is 150 Hz. It must be noted that the reduced voltage at the motor terminals compared to the rated motor voltage means that the motor goes into field weakening operation earlier.

L19
Connection for external auxiliary equipment

An outgoing feeder fused with max. 10 A for external auxiliary equipment (for example, separately driven motor fan).

The voltage is tapped at the drive converter input upstream of the main contactor/circuit breaker and, therefore, has the same level as the supply voltage.

The outgoing feeder can be switched inside the drive converter or externally.

Terminal -X155:	Meaning	Range
1	L1	380 ... 690 V AC
2	L2	380 ... 690 V AC
3	L3	380 ... 690 V AC
11	Contactor control	230 V AC
12	Contactor control	230 V AC
13	Feedback signal, circuit breaker	230 V AC/0.5 A; 24 V DC/2 A
14	Feedback signal, circuit breaker	230 V AC/0.5 A; 24 V DC/2 A
15	Feedback signal, contactor	230 V AC/6 A
16	Feedback signal, contactor	230 V AC/6 A
PE	PE	–

L26
Main control switch incl. fuses or circuit breakers

Up to 800 A a switch disconnector with fuses is available as main switch. For currents greater than 800 A, a circuit breaker provided as standard is used to isolate the drive system from the line supply. The circuit breaker is controlled and supplied within the converter.

Terminal -X50:	Meaning
1	Checkback contact (NO contact) main control switch/circuit breaker closed
2	Checkback contact (NC contact) main control switch/circuit breaker closed
3	Common potential

L45
EMERGENCY OFF pushbutton, installed in the cabinet door

The option **L45** only includes the EMERGENCY OFF pushbutton which is fitted with a protective collar in the cabinet door of the converter. The contacts of the pushbutton are brought out and connected to a terminal block.

The EMERGENCY OFF functions and/or EMERGENCY STOP functions of Category 0 or 1 can be activated in conjunction with options **L57, L59** and **L60**.

Terminal -X120:	Meaning
1	Checkback contact of the EMERGENCY OFF pushbutton in the cabinet door
2	Checkback contact of the EMERGENCY OFF pushbutton in the cabinet door
3	Checkback contact of the EMERGENCY OFF pushbutton in the cabinet door [1]
4	Checkback contact of the EMERGENCY OFF pushbutton in the cabinet door [1]

Notice: By pressing the EMERGENCY OFF pushbutton, the motor is stopped either uncontrolled or controlled depending on the selected Stop Category 0 or 1, and the main voltage disconnected from the motor, in compliance with IEC 60204-1 (VDE 0113). Auxiliary voltages such as the supply for a separately driven fan or anti-condensation heating may still be present. Certain areas within the converter also remain live (under voltage), such as the control or auxiliaries. If complete disconnection of all voltages is required, the EMERGENCY OFF pushbutton must be incorporated into a protective system to be implemented by the customer. For this purpose, an NC contact is provided at terminal -X120.

L50
Cabinet illumination with service socket

One handheld light with an integrated service socket is installed in each cabinet panel.

The power supply (at terminal block -X390) for the cabinet lighting and socket must be provided externally and fused with max. 10 A. The cabinet lighting is manually switched on.

Terminal -X390:	Meaning
1	L1 (230 V AC)
2	N
3	PE

L55
Cabinet anti-condensation heating

The anti-condensation heating is recommended at low ambient temperatures and high levels of humidity to prevent condensation. A 100 W electrical cabinet heater is installed for each cabinet element (two heating units are installed for each element for cabinet element widths from 800 mm to 1200 mm).

The power supply for the anti-condensation heating (110 V to 230 V AC, at terminal block -X240) must be provided externally and fused with max. 16 A.

Terminal -X240:	Meaning
1	L1 (110 ... 230 V AC)
2	N
3	PE

[1] For option **L57** to **L60** preassigned in the converter.

Options

L57
EMERGENCY OFF Stop Category 0, 230 V AC or 24 V DC

EMERGENCY OFF Stop Category 0 for an uncontrolled stop in accordance with EN 60204-1.

The function includes disconnecting the voltage at the converter using the line contactor and bypassing the microprocessor controller using a safety combination according to EN 60204-1. The motor then coasts down. When shipped, the pushbutton circuit is preset to 230 V AC. Jumpers must be appropriately set when using 24 V DC.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"ON" for monitored start; remove jumper 15-16!
16	"ON" for monitored start; remove jumper 15-16!
17	Checkback signal, "safety combination has tripped"
18	Checkback signal, "safety combination has tripped"

L59
EMERGENCY STOP Stop Category 1, 230 V AC

EMERGENCY STOP Stop Category 1 for a controlled stop in accordance with EN 60204-1.

The function stops the drive using a fast Stop along a down ramp that is parameterized by the user. The voltage is then disconnected as described for EMERGENCY OFF Stop Category 0 (option **L57**). The pushbutton circuit is operated at 230 V AC.

In order to maintain the specified stopping times, it may be necessary to use a braking unit.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"ON" for manual start; remove jumper 15-16!
16	"ON" for manual start; remove jumper 15-16!
17	Checkback signal, "safety combination has tripped"
18	Checkback signal, "safety combination has tripped"

L60
EMERGENCY STOP Stop Category 1, 24 V DC

EMERGENCY STOP Stop Category 1 for a controlled stop in accordance with EN 60204-1.

The function stops the drive using a fast stop along a down ramp that is parameterized by the user. The voltage is then disconnected as described for EMERGENCY OFF Stop Category 0 (option **L57**). The pushbutton circuit is operated at 24 V DC.

In order to maintain the specified stopping times, it may be necessary to use a braking unit.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"ON" for manual start; remove jumper 15-16!
16	"ON" for manual start; remove jumper 15-16!
17	Checkback signal, "safety combination has tripped"
18	Checkback signal, "safety combination has tripped"

Options

L61, L62, L64, L65
Braking units

Braking units may be required for drives in which motors might operate in generator mode but have no other facility for feeding energy back into the supply system.

The braking unit comprises two components:

- A Braking Module which can be installed in the air discharge of the chassis format power units
- A braking resistor to be mounted externally (IP20 degree of protection).

The braking unit functions as an autonomous unit, and does not require an external power supply. During the braking process, the kinetic energy is converted into heat in the externally mounted braking resistor.

A max. cable length of 100 m is permissible between the Braking Module and the braking resistor. This allows the braking resistor to be mounted externally so that heat losses can be dissipated outside the converter enclosure. The braking resistor is connected directly to the terminal -X5 of the converter.

The following braking units are available for SINAMICS S150 Converter Cabinet Units:

Option	SINAMICS S150 converter	**Braking Module**		
	Type rating	Rated power P_{DB}	Braking power P_{20}	Peak power P_{15}
	kW	kW	kW	kW
380 ... 480 V 3 AC				
L61	110 ... 132	25	100	125
L62	160 ... 800	50	200	250
500 ... 600 V 3 AC				
L64	75 ... 132	25	100	125
L65	160 ... 1200	50	200	250
660 ... 690 V 3 AC				
L61	75 ... 132	25	100	125
L62	160 ... 1200	50	200	250

P_{DB} = rated power (continuous braking power)

$P_{20} = 4 \times P_{DB}$: 20 s power referred to a braking interval of 90 s

$P_{15} = 5 \times P_{DB}$: 15 s power referred to a braking interval of 90 s

If more braking power is required than provided by the braking units listed here, then braking units may be connected in parallel for higher converter outputs (on request). In this case, one Braking Module is assigned to each braking resistor.

Load diagram for Braking Modules and braking resistors

Additional notes about possible duty cycles of the braking resistors and other engineering notes are included in the SINAMICS Low Voltage Engineering Manual.

Options

L83
Thermistor motor protection unit (alarm)

Thermistor motor protection device for PTC temperature thermistors (PTC resistors, type A) for alarm. The thermistor motor protection unit is supplied with power and evaluated internally in the converter.

Terminal -B127:	Meaning
T1	Sensor loop connection
T2	Sensor loop connection

L84
Thermistor motor protection unit (trip)

Thermistor motor protection device for PTC temperature thermistors (PTC resistors, type A) for trip. The thermistor motor protection unit is supplied with power and evaluated internally in the converter.

Terminal -B125:	Meaning
T1	Sensor loop connection
T2	Sensor loop connection

L86
Pt100 evaluation unit

The Pt100 evaluation unit can monitor up to 6 sensors. The sensors can be connected with two or three conductors to the evaluation unit. The limit values can be freely programmed for each channel.

In the factory setting, the measuring channels are subdivided into two groups, each with 3 channels. With motors, for example, this means that three Pt100s in the stator windings and two Pt100s in the motor bearings can be monitored. Unused channels can be suppressed via parameters.

The output relays are integrated into the internal fault and shutdown sequence of the converter.

L87
Insulation monitoring

An insulation monitor must be used if the converter is connected to an ungrounded line supply. The device monitors the entire galvanically coupled circuit for insulation faults.

An alarm is output in the event of a fault.

Notice: Only **one** insulation monitor can be used in each galvanically coupled network.

As there are different response strategies when a ground fault occurs in an ungrounded system, output relays of the insulation monitor are provided for integration in a plant-side control. The customer can also choose to integrate the outputs into the converter monitoring system.

Terminal -A101:	Meaning
11	Signaling relay ALARM 1 base
12	Signaling relay ALARM 1 NC contacts
14	Signaling relay ALARM 1 NO contacts
21	Signaling relay ALARM 2 base
22	Signaling relay ALARM 2 NC contacts
24	Signaling relay ALARM 2 NO contacts
M+	External kΩ display 0 µA to 400 µA
M-	External kΩ display 0 µA to 400 µA
R1	External reset button (NC contact or wire jumper otherwise the fault code is not stored)
R2	External reset button (NC contact or wire jumper)
T1	External test button
T2	External test button

M06
Base 100 mm high, RAL 7022

The additional cabinet base allows larger bending radii for cables (cable inlet from below) and enables them to be routed within the cabinet base.

The cabinet base is supplied in RAL 7022 in all cases. A special paint finish is not available for the base. It is delivered completely assembled with the cabinet. The mounting height of the operator panel changes accordingly.

M07
Cable-marshalling space 200 mm high, RAL 7035

The cable-marshalling space is made of strong sheet steel and allows cables to be connected more flexibly (entry from below). It also allows routing of cables within the marshalling compartment. It is delivered completely assembled with the cabinet. The mounting height of the operator panel changes accordingly.

Notice: The cable-marshalling space is painted as standard with RAL 7035. If a special color is requested for the cabinet (option **Y09**), the cable-marshalling space is also painted in this color.

Options

M13
Line connection from above

The control cabinet is provided with an additional roof section to allow a line connection from above. The connecting lugs for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located inside the roof section.

This increases the cabinet height by 405 mm. The busbars for connection from above are fully mounted when the cabinet is delivered. For transport reasons, the roof sections are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used. However, they must be removed on site before the roof sections can be installed. Use of rope spreaders should be considered in the case of small crane hook heights.

An undrilled aluminum mounting plate (5 mm thick) is provided in the roof section for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

Note: The control cables are still connected from below. Option **M13** eliminates the lugs, provided as standard, to connect the line supply from below.

The degree of protection of the roof sections is IP21. In combination with options **M23, M43** and **M54** , additional plastic ventilation grilles and filter elements are provided.

Notice: The roof sections are colored RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roof section is also painted in this color. Ventilation grilles used with IP23 and IP54 degrees of protection have an RAL 7035 color and cannot be painted.

The covers provided with option **M60** are also included in the scope of supply.

M21
IP21 degree of protection

Cabinet version in IP20, but with additional top or drip protection cover. This increases the cabinet height by 250 mm.

For transport reasons, the top or drip protection covers are delivered separately and must be fitted on site.

Notice: The top or drip protection covers are painted in RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roof sections or drip protection panel are also painted in this color.

M23
IP23 degree of protection

Converter cabinet units with IP23 degree of protection are supplied with additional roof sections and plastic ventilation grilles in the air inlet and outlet. This increases the cabinet height by 400 mm. The covers provided with option **M60** are also included in the scope of supply. For transport reasons, the roof sections are delivered separately and must be fitted on site.

Notice: The roof sections are colored RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roof section is also painted in this color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.

M43
IP43 degree of protection

Converter cabinet units with IP43 degree of protection are supplied with additional roof sections as well as plastic ventilation grilles and a wire mesh in the air inlet and outlet. This increases the cabinet height by 400 mm. The covers provided with option **M60** are also included in the scope of supply. They are an integral component of the internal cabinet air guidance system and are adapted accordingly.

For transport reasons, the roof sections are delivered separately and must be fitted on site.

Notice: The roof sections are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the roof sections are also painted in this color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.

M54
IP54 degree of protection

Converter cabinet units with IP54 degree of protection are supplied with additional roof sections as well as plastic ventilation grilles and a filter medium in the air inlet and outlet. This increases the cabinet height by 400 mm. The covers provided with option **M60** are also included in the scope of supply. They are an integral component of the internal cabinet air guidance system and are adapted accordingly. The filters must be maintained according to the local environmental conditions.

Notice:

- The roof sections are colored RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roof section is also painted in this color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.
- For units with IP54 degree of protection, it is important to observe the derating factor for output currents in relation to ambient temperature and installation altitude.

M60
Additional touch protection

The converter cabinet units are designed as standard according to BGV A3. Option **M60** provides additional covers (outside arm's reach) in the vicinity of the AC busbars and above the power unit (can only be selected as an option with converters up to 250 kW in the 400 V range and with converters up to 315 kW in the 690 V range with degrees of protection IP20 and IP21; otherwise supplied as standard).

Options

M66
Marine version

For compliance with the requirements of the classification institutes:

- Lloyds Register
- American Bureau of Shipping
- Germanischer Lloyd
- Bureau Veritas
- Det Norske Veritas
- Chinese Classification Society

This option includes a strengthened mechanical version of the cabinet, handles (handrail) below the operator panel and mechanical locking of the cabinet doors. The cabinet has degree of protection IP23 (option **M23**) and includes cabinet anti-condensation heating (option **L55**). To attach the drive converter to the ship's deck, a welding frame (5 mm high) is supplied separately.

Note: A combination with options **M21**, **M23** and **L55** is not possible. Individual certification is additionally required if the converter is used for a safety-relevant drive on the ship (see options **E11** to **E71**).

M70
EMC shield bus (cable connection from below)

The EMC shield bus is used to connect shielded power cables for the line supply and motor feeder cables. With the options **M13** and **M78**, the EMC shield bus is already included as standard for the connection busbars underneath the roof section.

M78
Motor connection from above

The control cabinet is provided with an additional roof section for a motor connection from above. The connecting lugs for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located inside the roof section.

This increases the cabinet height by 405 mm. The busbars for connection from above are fully mounted when the cabinet is delivered. For transport reasons, the roof sections are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used. However, they must be removed on site before the roof sections can be installed. Use of rope spreaders should be considered in the case of small crane hook heights.

An undrilled aluminum mounting plate (5 mm thick) is provided in the roof section for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

Note: The control cables are still connected from below. Option **M78** eliminates the lugs, provided as standard, to connect the motor from below.

The degree of protection of the roof sections is IP21. In combination with options **M23, M43** and **M54** , additional plastic ventilation grilles and filter elements are provided.

Notice: The roof sections are colored RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roof sections are also painted in this color. Ventilation grilles used with IP23, IP43 and IP54 degrees of protection have an RAL 7035 color and cannot be painted.

The covers provided with option **M60** are also included in the scope of supply.

M90
Crane transport assembly (top-mounted)

In the case of single cabinets up to a width of 600 mm, transport eyebolts are provided to transport the unit by crane. For cabinet widths of 800 mm and wider, transport rails are used.

T58, T60, T80
Rating plate data

The rating plate is provided in English/German as standard. A rating plate in another language can be selected by specifying the following option order codes.

Option	Rating plate language
T58	English/French
T60	English/Spanish
T80	English/Italian

Y09
Special cabinet paint finish

The converter cabinet units are painted with RAL 7035 as standard. The special paint finish must be stated in plain text in the order. All RAL colors which are available as powder coatings can be selected.

Notice: If options such as cable-marshalling space (option **M07**), top or drip protection covers (option **M21**), roof sections (options **M23/M43/M54**) or cable connection from above (options **M13/M78**) are ordered for the converter cabinet units, they will also be supplied in the paint finish stated in the order. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.

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Overview

The fuses specified below are the recommended types for protecting the unit on the low-voltage distribution panel. If option **L26** was selected for SINAMICS S150 with rated input currents < 800 A, then the semiconductor protection is already integrated in the unit. For units > 800 A, this function is realized by the circuit breaker provided as standard. In this case, a 3NA fuse can be used in the distribution system. If option **L26** has not been selected for units < 800 A, then we strongly advise that 3NE fuses are used. [1)]

Catalog LV 10.1 contains additional information on the fuses that have been listed.

Type rating at 400 V or 690 V		SINAMICS S150 converter	**Cable protection fuse in systems with fuse switch disconnector**			**Cable protection fuse (incl. semiconductor protection) in systems without fuse switch disconnector**		
For I_L, 50 Hz 400 V, 500 V or 690 V	For I_L, 60 Hz 460 V or 575 V			Rated current	Frame size acc. to IEC 60269-2		Rated current	Frame size acc. to IEC 60269-2
kW	hp	6SL3710-...	Order No.	A		Order No.	A	
Line voltage 380 ... 460 V 3 AC								
110	150	7LE32-1AA3	**3NA3252**	315	2	**3NE1230-2**	315	1
132	200	7LE32-6AA3	**3NA3254**	355	2	**3NE1331-2**	350	2
160	250	7LE33-1AA3	**3NA3365**	500	3	**3NE1334-2**	500	2
200	300	7LE33-8AA3	**3NA3365**	500	3	**3NE1334-2**	500	2
250	400	7LE35-0AA3	**3NA3372**	630	3	**3NE1436-2**	630	3
315	500	7LE36-1AA3	**3NA3475**	800	4	**3NE1438-2**	800	3
400	600	7LE37-5AA3	**3NA3475**	800	4	**3NE1448-2**	850	3
450	700	7LE38-4AA3	–	–	–	Circuit breaker included as standard		
560	800	7LE41-0AA3	–	–	–	Circuit breaker included as standard		
710	1000	7LE41-2AA3	–	–	–	Circuit breaker included as standard		
800	1000	7LE41-4AA3	–	–	–	Circuit breaker included as standard		
Line voltage 500 ... 690 V 3 AC								
75	75	7LG28-5AA3	**3NA3132-6**	125	1	**3NE1022-2**	125	00
90	75	7LG31-0AA3	**3NA3132-6**	125	1	**3NE1022-2**	125	00
110	100	7LG31-2AA3	**3NA3136-6**	160	1	**3NE1224-2**	160	1
132	150	7LG31-5AA3	**3NA3240-6**	200	2	**3NE1225-2**	200	1
160	150	7LG31-8AA3	**3NA3244-6**	250	2	**3NE1227-2**	250	1
200	200	7LG32-2AA3	**3NA3252-6**	315	2	**3NE1230-2**	315	1
250	250	7LG32-6AA3	**3NA3354-6**	355	3	**3NE1331-2**	350	2
315	300	7LG33-3AA3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
400	400	7LG34-1AA3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
450	450	7LG34-7AA3	**3NA3352-6**	2 × 315	2	**3NE1435-2**	560	3
560	600	7LG35-8AA3	**3NA3354-6**	2 × 355	3	**3NE1447-2**	670	3
710	700	7LG37-4AA3	**3NA3365-6**	2 × 500	3	**3NE1448-2**	850	3
800	800	7LG38-1AA3	–	–	–	Circuit breaker included as standard		
900	900	7LG38-8AA3	–	–	–	Circuit breaker included as standard		
1000	1000	7LG41-0AA3	–	–	–	Circuit breaker included as standard		
1200	1250	7LG41-3AA3	–	–	–	Circuit breaker included as standard		

[1)] The double function fuses (3NE1.) with duty class gS for cable and semiconductor protection are recommended to protect the converter. These fuses are specially adapted to the requirements of the semiconductors in the input rectifier.
- super flink
- coordinated to the I2t integral of the semiconductor
- lower arc voltage
- better current limiting (lower let-through I2t values)

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SINAMICS S150 Converter Cabinet Units

Cable cross-sections and connections

Overview

The following tables list the recommended and maximum connectable line and motor-side cable cross sections and connections for a single connection.

The recommended cross-sections are based on the specified fuses. They are valid for a three-conductor copper cable routed horizontally in air with PVC insulation and a permissible conductor temperature of 70 °C (e.g. Protodur NYY or NYCWY) at an ambient temperature of 40 °C and individual routing.

For deviating conditions (cable routing, cable accumulation, ambient temperature), the appropriate correction factors according to IEC 60364-5-52 must be taken into account.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

Type rating at 400 V or 690 V	SINAMICS S150 Converter Cabinet Unit	Line supply connection			Motor connection			Cabinet grounding	
		Recommended cross-section [1]	Max. cable cross-section	Fixing screw M12	Recommended cross-section [1]	Max. cable cross-section	Fixing screw M12	Fixing screw M12	Remarks
		IEC	IEC	(Number of holes)	IEC	IEC	(Number of holes)	(Number of holes)	
kW	6SL3710-...	mm²	mm²		mm²	mm²			
380 ... 480 V 3 AC									
110	7LE32-1AA3	2 × 70	4 × 240	(2)	2 × 50	2 × 150	(2)	(2)	
132	7LE32-6AA3	2 × 95	4 × 240	(2)	2 × 70	2 × 150	(2)	(2)	
160	7LE33-1AA3	2 × 120	4 × 240	(2)	2 × 95	2 × 150	(2)	(2)	
200	7LE33-8AA3	2 × 120	4 × 240	(2)	2 × 95	2 × 150	(2)	(2)	
250	7LE35-0AA3	2 × 185	4 × 240	(2)	2 × 150	2 × 240	(2)	(2)	
315	7LE36-1AA3	2 × 240	4 × 240	(2)	2 × 185	4 × 240	(2)	(2)	
400	7LE37-5AA3	3 × 185	4 × 240	(2)	2 × 240	4 × 240	(2)	(10)	Cu bar
450	7LE38-4AA3	4 × 150	8 × 240	(4)	3 × 185	4 × 240	(2)	(16)	Cu bar
560	7LE41-0AA3	4 × 185	8 × 240	(4)	4 × 185	6 × 240	(3)	(18)	Cu bar
710	7LE41-2AA3	4 × 240	8 × 240	(4)	4 × 240	6 × 240	(3)	(18)	Cu bar
800	7LE41-4AA3	6 × 185	8 × 240	(4)	6 × 185	6 × 240	(3)	(18)	Cu bar
500 ... 690 V 3 AC									
75	7LG28-5AA3	50	4 × 240	(2)	35	2 × 70	(2)	(2)	
90	7LG31-0AA3	50	4 × 240	(2)	50	2 × 150	(2)	(2)	
110	7LG31-2AA3	70	4 × 240	(2)	70	2 × 150	(2)	(2)	
132	7LG31-5AA3	95	4 × 240	(2)	70	2 × 150	(2)	(2)	
160	7LG31-8AA3	120	4 × 240	(2)	95	2 × 150	(2)	(2)	
200	7LG32-2AA3	2 × 70	4 × 240	(2)	120	2 × 150	(2)	(2)	
250	7LG32-6AA3	2 × 95	4 × 240	(2)	2 × 70	2 × 185	(2)	(2)	
315	7LG33-3AA3	2 × 120	4 × 240	(2)	2 × 95	2 × 240	(2)	(2)	
400	7LG34-1AA3	2 × 185	4 × 240	(2)	2 × 120	4 × 240	(2)	(2)	
450	7LG34-7AA3	2 × 185	4 × 240	(2)	2 × 150	4 × 240	(2)	(2)	
560	7LG35-8AA3	2 × 240	4 × 240	(2)	2 × 185	4 × 240	(2)	(2)	
710	7LG37-4AA3	3 × 185	8 × 240	(4)	3 × 150	6 × 240	(3)	(18)	Cu bar
800	7LG38-1AA3	4 × 150	8 × 240	(4)	3 × 185	6 × 240	(3)	(18)	Cu bar
900	7LG38-8AA3	4 × 150	8 × 240	(4)	4 × 150	6 × 240	(3)	(18)	Cu bar
1000	7LG41-0AA3	4 × 185	8 × 240	(4)	4 × 185	6 × 240	(3)	(18)	Cu bar
1200	7LG41-3AA3	4 × 240	8 × 240	(4)	4 × 240	6 × 240	(3)	(18)	Cu bar

[1] The recommendations for the North American market in AWG or MCM must be taken from the corresponding standards NEC (National Electrical Code) or CEC (Canadian Electrical Code).

Overview

Cable cross-sections required for connecting to the line supply and to motors

It is generally recommended to use shielded 3-conductor three-phase cables between the converter and motor – and for higher power ratings, symmetrical cables where possible. If required, several of these cables can be connected in parallel. There are two main reasons for this:

- Only then can the high IP55 degree of protection at the motor terminal box be easily achieved. The reason for this is that cables are routed into the terminal box through glands, and the number of possible glands is restricted by the terminal box geometry. Individual cables are less suitable in achieving this.
- For symmetrical 3-conductor three-phase cables, the summed ampere turns over the outer cable diameter are zero. This means that they can be routed in metallic, conductive cable ducts or cable trays without any problems and without any noticeable currents being induced in the conductive connections (ground and leakage currents). The risk of induced leakage currents and therefore increased cable sheath losses is significantly higher for single-conductor cables.

The cable cross-section required depends on the current being conducted in the cable. The permissible current load capability of cables is defined, for example in IEC 60364-5-52. On one hand this is dependent on the ambient conditions, such as temperature, and on the other hand, the type of routing. It must be taken into account whether cables are individually routed with relatively good cooling, or whether several cables are routed together; in this case, cable ventilation is significantly poorer, which can therefore result in higher cable temperatures. Regarding this topic, reference is made to the corresponding correction factors for these secondary conditions in IEC 60364-5-52.

For 3-conductor copper and aluminum cables with PVC insulation and a permissible conductor temperature of 70 °C (e.g. Protodur NYY or NYCWY), as well as an ambient temperature of 40 °C, the cross-sections can be determined from the information provided in the following table, which is based on IEC 60364-5-52.

Cross-section of 3-conductor cable	**Copper cable**		**Aluminum cable**	
	Individual routing	Several cables lying next to one another [1]	Individual routing	Several cables lying next to one another [1]
mm²	A	A	A	A
3 × 2.5	22	17	17	13
3 × 4.0	30	23	23	18
3 × 6.0	37	29	29	22
3 × 10	52	41	40	31
3 × 16	70	54	53	41
3 × 25	88	69	68	53
3 × 35	110	86	84	65
3 × 50	133	104	102	79
3 × 70	171	133	131	102
3 × 95	207	162	159	124
3 × 120	240	187	184	144
3 × 150	278	216	213	166
3 × 185	317	247	244	190
3 × 240	374	292	287	224

Current-carrying capacity according to IEC 60364-5-52 at 40 °C

Cables must be connected in parallel for higher currents.

[1] A maximum of 9 cables may be routed directly next to one another horizontally on a cable tray.

Note: The recommendations for the North American market in AWG or MCM must be taken from the corresponding standards NEC (National Electrical Code) or CEC (Canadian Electrical Code).

Grounding and protective conductor cross-section

The protective conductor must be dimensioned taking into account the following data:

- In the case of a ground fault, it is not permissible that inadmissibly high contact voltages occur as a result of voltage drops along the protective conductor caused by the ground fault current (< 50 V AC or < 120 V DC, IEC 61800-5-1, IEC 60364, IEC 60543).
- The protective conductor must not be excessively loaded by any ground fault current it carries.
- If it is possible for continuous currents to flow through the protective conductor when a fault occurs, then the protective conductor cross-section must be dimensioned for this continuous current.
- The protective conductor cross-section must be selected according to EN 60204-1, EN 60439-1, IEC 60364.

Cross-section, line conductor	Minimum cross-section, external protective conductor
mm²	mm²
up to 16	Minimum cross-section of external conductor
16 ... 35	16
from 35	At least half the cross-section of external conductor

Note: The recommendations for the North American market in AWG or MCM must be taken from the corresponding standards NEC (National Electrical Code) or CEC (Canadian Electrical Code).

- Switchgear and motors are usually grounded separately via a local ground electrode. With this constellation, the ground fault current flows via the parallel ground connections and is divided. In spite of the relatively low protective conductor cross-sections used in accordance with the table above, no inadmissible touch voltages occur with this grounding system. However, from experience gained with different grounding constellations, we recommend that the ground cable from the motor returns directly to the drive converter. For EMC reasons and in order to avoid bearing currents, for large power ratings, it is preferable to use symmetrical 3-conductor, three-phase cables instead of four-conductor cables. For 3-conductor cables, the protective or PE conductor must be routed separately or arranged symmetrically in the motor cable. The symmetry of the PE conductor is achieved using a conductor surrounding all phase conductors or using a cable with a symmetrical arrangement of the three phase conductors and three ground conductors.
  For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.
- Through their high-speed control, the converters limit the load current (motor and ground fault currents) to an rms value corresponding to the rated current. As a result of this fact, we recommend that the cross-section of the protective conductor to ground the cabinets is the same as for the outer (main) conductor.

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Overview

Mounting device for power blocks

Power block mounting device for installing and removing the power blocks for the Basic Line Modules, Smart Line Modules, Active Line Modules and Motor Modules in chassis format.

The mounting device is a mounting aid. It is placed in front of the module and attached to the module. The telescopic rails allow the device to be adjusted to the installation height of the power blocks.

Once the mechanical and electrical connections have been released, the Power block can be removed from the module.

The power block is guided and supported by the guide rails on the handling device.

Selection and ordering data

Description	Order No.
Mounting device for installing and removing power blocks	**6SL3766-1FA00-0AA0**

Chapter 3.2

Technical Literature -

SINAMICS GM150 VFD

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SINAMICS GM150
SINAMICS SM150

Supplement for Catalog D 12 2012

SINAMICS Drives

Catalog Supple-ment

Edition 12/2013

Answers for industry.

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SINAMICS GM150
SINAMICS SM150

Medium-Voltage Converters

Supplement for Catalog D 12 2012

12/09/2013

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1 Options

1.1 New options

1.1.1 G51 to G54 TM150 Terminal Module, temperature sensor evaluation units (SINAMICS GM150; SINAMICS SM150 on request)

Overview

With options G51 to G54, one to four TM150 Terminal Modules can be ordered for evaluation of several temperature sensors.

Table 1-1 Options G51 to G54

Kurzangabe	Option
G51	1 x TM150 temperature sensor evaluation unit
G52	2 x TM150 temperature sensor evaluation units
G53	3 x TM150 temperature sensor evaluation units
G54	4 x TM150 temperature sensor evaluation units

The TM150 Terminal Module is a DRIVE-CLiQ component for temperature evaluation. The temperature is measured in a temperature range from –99 °C to +250 °C for the following temperature sensors:

- Pt100 (with monitoring for open-circuit and short-circuit)
- Pt1000 (with monitoring for open-circuit and short-circuit)
- KTY84 (with monitoring for open-circuit and short-circuit)
- PTC (with short-circuit monitoring)
- Bimetallic NC contact (without monitoring)

For the temperature sensor inputs, for each terminal block the evaluation can be parameterized for 1x2-wire, 2x2-wire, 3-wire or 4-wire. There is no galvanic isolation in the TM150.

The temperature channels of a TM150 can be subdivided into three groups and evaluated together.

Note

With the introduction of the options G51 to G54 described above, options L80 to L82 (thermistor protection relays) and L90 to L94 (Pt100 evaluation units) are not available anymore.

This also applies to catalog pages 2/11, 3/9, 4/9, 5/12, 6/5 f and 6/28 ff.

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Design

The following are located on the TM150 Terminal Module:

- 6/12 temperature sensor inputs
- 2 DRIVE-CLiQ sockets

The status of the TM150 Terminal Module is indicated via a multi-color LED. The TM150 Terminal Module is designed to be snapped onto a TH35 top-hat rail in accordance with EN 60715.

Technical data

Table 1-2 TM150 technical data

TM150 Terminal Module	
Current requirement, max. at 24 V DC • Conductor cross-section, max. • Fuse protection, max.	0.5 A 2.5 mm^2 20 A
Temperature sensor inputs The inputs can be parameterized individually for the evaluation of sensors. • Conductor cross-section, max. • Measuring current per sensor, approx.	 1.5 mm^2 0.8 mA
PE connection	M4 screw
Dimensions • Width • Height • Depth	 30 mm 150 mm 119 mm
Weight, approx.	0.41 kg

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Figure 1-1 Connection example of a TM150 Terminal Module

1.1.2 L10 dv/dt filter (SINAMICS GM150 in IGCT version, SINAMICS SM150 in IGCT version)

Overview

The converter generates pulses at the output that stress the motor insulation. The dv/dt filter limits the voltage gradients at the converter output to max. 1 kV/µs and simultaneously reduces the capacitive charge/discharge currents of motor cables.

Design

The dv/dt filter is water-cooled and integrated in the Motor Module (see following diagram).

Figure 1-2 Block diagram option L10

Note

Using option L10, the following restrictions apply:

- The maximum pulse frequency of the converter is 200 Hz.
- The deionized water requirement of the cooling unit is 10 liters larger than given in the technical data.
- The output currents must be limited according to the following table.

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Table 1-3 Reduction of the output current using option L10

Order No.	Rated output current without L10 A	Rated output current with L10 A
SINAMICS GM150 in IGCT version		
6SL3835-2LN41-8AA0	1750	1680
6SL3835-2LN42-8AA0	2 x 1360	2 x 1360
6SL3835-2LN43-6AA0	2 x 1570	2 x 1570
6SL3835-2LN44-2AA0	3 x 1220	3 x 1220
6SL3835-2LR41-8AT0	2 x 1750	2 x 1680
6SL3835-2LR42-1AT0	2 x 2100	2 x 2030
SINAMICS SM150 in IGCT version		
6SL3845-7NN41-8AA0	1750	1680
6SL3845-7NN43-6AA0	2 x 1750	2 x 1680
6SL3845-7NN45-4AA0	3 x 1750	3 x 1680
6SL3845-7NN41-8AB0	2 x 1750	2 x 1680
6SL3845-7NN41-8AC0	3 x 1750	3 x 1680
6SL3845-7NN41-8AD0	4 x 1750	4 x 1680
6SL3845-7NN41-8AF0	3 x 1750	3 x 1680
6SL3845-7NN41-8AG0	4 x 1750	4 x 1680
6SL3845-7NN41-8AK0	5 x 1750	5 x 1680
6SL3845-7NN43-6AF0	1 x (2 x 1750) + 2 x 1750	1 x (2 x 1680) + 2 x 1680
6SL3845-7NN42-2AA0	1850	1780
6SL3845-7NN44-5AA0	2 x 1850	2 x 1780
6SL3845-7NN46-7AA0	3 x 1850	3 x 1780

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1.2 Options with changed availability

1.2.1 E82
Increased frequency (converter for high-speed rotors)

Option E82 is no longer available.

Note
This change applies to catalog pages 6/3 and 6/12.

1.2.2 G20 to G24
Access to other bus systems

The options G20 to G24 are available without request now. The resulting changes for SINAMICS GM150 in IGBT and IGCT version can be seen in the following overview by means of the related excerpt of catalog page 6/4.

Table 1-4 Availability of options G20 to G24

Order code	Option	SINAMICS GM150 IGBT version	SINAMICS GM150 IGCT version
Version released 2012			
G20	CAN bus interface	On request	On request
G21	Modbus Plus interface	On request	On request
G22	Modbus RTU slave interface	On request	On request
G23	DeviceNet interface	On request	On request
G24	PROFINET interface (via CBE20)	On request	On request
New			
G20	CAN bus interface	✓	✓
G21	Modbus Plus interface	✓	On request
G22	Modbus RTU slave interface	✓	✓
G23	DeviceNet interface	✓	On request
G24	PROFINET interface (via CBE20)	✓	On request

Note
These changes also apply to catalog pages 2/12, 3/10 and 6/15.

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1.2.3 L08 Output reactor

The option L08 is only available for the IGBT versions of SINAMICS GM150 and SINAMICS SM150 now. For the IGCT versions of the converters, option L10 (dv/dt filter) is available (refer to section 1.1.2).

Table 1-5 Availability of option L08 (catalog page 6/5)

Order code	Option	SINAMICS GM150 IGBT version	SINAMICS GM150 IGCT version	SINAMICS SM150 IGBT version	SINAMICS SM150 IGCT version
Version released 2012					
L08	Output reactor	✓	✓	✓	✓
New					
L08	Output reactor	✓	–	✓	–

Note
This change also applies to catalog pages 3/8, 5/11 and 6/22.

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1.2.4 Y15 Sine-wave filter

For the converter types marked in red in the following reproduction of catalog page 2/9, option Y15 (sine-wave filter) is not available anymore with immediate effect.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 as IGBT version

Selection and ordering data

Type rating kVA	Shaft output kW	hp	Rated output current A	SINAMICS GM150 as IGBT version, water cooling, without sine-wave filter Order No.	Circuit version (page 2/4) Fig. No.
Output voltage 2.3 kV					
2000	1650	2250	500	6SL3815-2LM35-0AA0	①
2200	1800	2500	550	6SL3815-2LM35-5AA0	①
2400	2000	2750	600	6SL3815-2LM36-0AA1	①
2600	2150	2950	660	6SL3815-2LM36-6AA1	①
2900	2450	3250	740	6SL3815-2LM37-4AA0	①
3200	2650	3500	800	6SL3815-2LM38-0AA0	①
3500	2900	3850	880	6SL3815-2LM38-8AA1	①
4000	3300	4400	1000	6SL3815-2LM41-0AA1	①
Output voltage 3.3 kV					
2000	1650	2250	350	6SL3815-2LN33-5AA0	①
2300	1900	2500	400	6SL3815-2LN34-0AA0	①
2600	2150	3000	450	6SL3815-2LN34-5AA0	①
2900	2400	3250	500	6SL3815-2LN35-0AA0	①
3100	2650	3500	550	6SL3815-2LN35-5AA0	①
3400	2800	3800	600	6SL3815-2LN36-0AA1	①
3800	3150	4200	660	6SL3815-2LN36-6AA1	①
4200	3500	4500	740	6SL3815-2LN37-4AA0	①
4600	3800	5000	800	6SL3815-2LN38-0AA0	①
5100	4250	6000	880	6SL3815-2LN38-8AA1	①
5700	4700	6150	1000	6SL3815-2LN41-0AA1	①
6300	5300	7000	2 × 550	6SL3815-2LN41-1AA1	③
6800	5600	7400	2 × 600	6SL3815-2LN41-2AA1	③
7400	6200	8000	2 × 650	6SL3815-2LN41-3AA0	③
8000	6700	9000	2 × 700	6SL3815-2LN41-4AA0	③
9100	7600	10200	2 × 800	6SL3815-2LN41-6AA1	③
10300	8600	11500	2 × 900	6SL3815-2LN41-8AA1	③
Output voltage 4.16 kV					
2000	1700	2250	280	6SL3815-2LP32-8AA0	①
2200	1850	2500	310	6SL3815-2LP33-1AA0	①
2500	2100	2750	350	6SL3815-2LP33-5AA0	①
2900	2400	3000	400	6SL3815-2LP34-0AA0	①
3200	2700	3500	450	6SL3815-2LP34-5AA0	①
3600	3000	4000	500	6SL3815-2LP35-0AA0	①
4000	3300	4500	550	6SL3815-2LP35-5AA0	①
4300	3600	4850	600	6SL3815-2LP36-0AA1	①
4800	4000	5450	660	6SL3815-2LP36-6AA1	①
5300	4500	6000	740	6SL3815-2LP37-4AA0	①
5800	4800	6500	800	6SL3815-2LP38-0AA0	①
6400	5300	7150	880	6SL3815-2LP38-8AA1	①
7200	5900	8000	1000	6SL3815-2LP41-0AA1	①
7900	6600	9000	2 × 550	6SL3815-2LP41-1AA1	③
8600	7150	9500	2 × 600	6SL3815-2LP41-2AA1	③
9400	7900	10000	2 × 650	6SL3815-2LP41-3AA0	③
10100	8500	11000	2 × 700	6SL3815-2LP41-4AA0	③
11500	9650	13000	2 × 800	6SL3815-2LP41-6AA1	③
13000	11250	15300	2 × 900	6SL3815-2LP41-8AA1	③

Type rating kVA	Shaft output kW	hp	Rated output current A	SINAMICS GM150 as IGBT version, water cooling, with sine-wave filter Order No.		Circuit version (page 2/5) Fig. No.
Output voltage 2.3 kV						
1500	1250	1500	380	6SL3815-2LM35-0AA0-Z	Y15	④
1650	1350	1750	410	6SL3815-2LM35-5AA0-Z	Y15	④
2150	1790	2400	540	6SL3815-2LM36-0AA1-Z	Y15	④
2200	1850	2500	550	6SL3815-2LM37-4AA0-Z	Y15	④
2350	1950	2550	590	6SL3815-2LM36-6AA1-Z	Y15	④
2400	2000	2750	600	6SL3815-2LM38-0AA0-Z	Y15	④
Output voltage 3.3 kV						
1550	1300	1750	270	6SL3815-2LN33-5AA0-Z	Y15	④
1750	1450	2000	310	6SL3815-2LN34-0AA0-Z	Y15	④
2000	1650	2250	350	6SL3815-2LN34-5AA0-Z	Y15	④
2150	1800	2500	380	6SL3815-2LN35-0AA0-Z	Y15	④
2350	1950	2750	410	6SL3815-2LN35-5AA0-Z	Y15	④
3100	2550	3400	540	6SL3815-2LN36-0AA1-Z	Y15	④
3200	2700	3500	560	6SL3815-2LN37-4AA0-Z	Y15	④
3400	2800	3700	590	6SL3815-2LN36-6AA1-Z	Y15	④
3500	2900	4000	610	6SL3815-2LN38-0AA0-Z	Y15	④
5500	4550	6000	960	6SL3815-2LN41-1AA1-Z	Y15	⑥
5600	4700	6250	980	6SL3815-2LN41-3AA0-Z	Y15	⑥
6050	5100	6500	1060	6SL3815-2LN41-4AA0-Z	Y15	⑥
6100	5100	7000	1060	6SL3815-2LN41-2AA1-Z	Y15	⑥
Output voltage 4.16 kV						
1600	1300	1750	220	6SL3815-2LP32-8AA0-Z	Y15	④
1750	1450	2000	240	6SL3815-2LP33-1AA0-Z	Y15	④
1950	1600	2250	270	6SL3815-2LP33-5AA0-Z	Y15	④
2250	1850	2500	310	6SL3815-2LP34-0AA0-Z	Y15	④
2500	2100	2750	350	6SL3815-2LP34-5AA0-Z	Y15	④
2800	2350	3000	390	6SL3815-2LP35-0AA0-Z	Y15	④
3100	2600	3500	430	6SL3815-2LP35-5AA0-Z	Y15	④
3900	3250	4450	540	6SL3815-2LP36-0AA1-Z	Y15	④
4100	3450	4500	570	6SL3815-2LP37-4AA0-Z	Y15	④
4250	3550	4750	590	6SL3815-2LP36-6AA1-Z	Y15	④
4500	3800	5000	625	6SL3815-2LP38-0AA0-Z	Y15	④
7150	5900	7950	960	6SL3815-2LP41-1AA1-Z	Y15	⑥
7350	6200	8000	1020	6SL3815-2LP41-3AA0-Z	Y15	⑥
7700	6350	8600	1080	6SL3815-2LP41-2AA1-Z	Y15	⑥
7950	6600	9000	1100	6SL3815-2LP41-4AA0-Z	Y15	⑥

The order code **Y15** (sine-wave filter) must be additionally specified and requires plain text
(see Description of the options, Page 6/42).

2

1.3 Updated option descriptions

The description of option S05 has been modified as follows.

1.3.1 S05
Industry sector neutral parameterization (SINAMICS SM150)

With option S05, an industry sector neutral parameterization for SINAMCIS SM150 is provided. Using this parameterization, the converter can be integrated into the system environment (e.g. control of circuit breakers, brakes, motor protection, etc.). Important drive parameters are already preset.

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2 Permissible cable lengths

2.1 With and without output reactor or dv/dt filter

The following table shows an update of the specifications of permissible cable lengths with and without output reactor (catalog page 9/14). In addition, the table includes specifications for operation with and without dv/dt filter.

Note

The option L08 (output reactor) is only available for SINAMICS GM150 and SINAMICS SM150 in **IGBT** version.

The option L10 (dv/dt filter) is only available for SINAMICS GM150 and SINAMICS SM150 in **IGCT** version.

Table 2-1 Maximum cable length

	Without output reactor (standard)	With output reactor (option **L08**) [1]			
SINAMICS GM150 IGBT version and SINAMICS SM150 IGBT version		Output current			
		400 A	600 A	800 A	1000 A
Output voltage 2.3 kV	Up to 2 parallel cables: each 100 m 3 parall cables: each 80 m 4 parall cables: each 80 m	1000 m			
Output voltage 3.3 kV		1000 m			
Output voltage 4.16 kV		1000 m	750 m	450 m	400 m
	Mechanically, up to six parallel cables are possible (on request).				
	Without dv/dt filter (standard)	With dv/dt filter (option **L10**) [1]			
SINAMICS GM150 IGCT version and SINAMICS SM150 IGCT version					
Output voltage 3.3 kV	Up to 2 parallel cables: each 100 m 3 parall cables: each 80 m 4 parall cables: each 80 m	200m Larger cable lengths on request			
	Mechanically, up to six parallel cables are possible (on request).				

1) Distance converter-motor depending on the current load for max. four shielded three-wire cables in parallel (when using single-core cables, refer to catalog page 9/13) – unshielded cables are not permitted

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Note

The specifications of converter cable lengths are based on the following assumptions:

- Max. ambient temperature: 40 °C
- Max. number of cables in parallel: 4
- Max. cable cross-section: 240 mm²
- Max. output frequency: 60 Hz

For smaller ambient temperatures, output frequencies, currents, cable cross-sections or a smaller number of cables routed in parallel, larger cable length are possible. Plant-specific information can be obtained from your local Siemens sales contact.

2.2 Between line-side transformer and converter

For SINAMICS GM150, the specification in the table " Maximum cable lengths between line-side transformer and converter" on page 9/14 changes as follows.

Table 2-2 Maximum cable lengths between line-side transformer and converter (catalog page 9/14)

Version released 2012			New		
Maximum cable lengths between line-side transformer and converter			Maximum cable lengths between line-side transformer and converter		
Converter	Max. cable lengths		Converter	Max. cable lengths	
	Shielded	Unshielded		Shielded	Unshielded
Output voltage 2.3 kV to 4.16 kV			Output voltage 2.3 kV to 4.16 kV		
SINAMICS GM150	300 m	300 m	SINAMICS GM150	300 m	Not permitted
Output voltage 3.3 kV			Output voltage 3.3 kV		
SINAMICS SM150	80 m	Not permitted	SINAMICS SM150	80 m	Not permitted

3 Static excitation units

The following tables show an update of the data for the static excitation units.

3.1 Static excitation units for brushless rotating reverse-field excitation

3.1.1 Technical data

Table 3-1 Technical data for rotating reverse-field excitation (catalog page 7/6); **changes marked in green**

Brushless rotating reverse-field excitation		**6RN7030-...**		**6RN7031-...**
		...-1RH31-3AA0 **...-1RF31-3AA0**	**...-2RH32-5AA0** **...-2RF32-5AA0**	**...-1RH32-5AA0-Z M66** **...-1RF32-5AA0-Z M66**
...	...	...	...	...
Dimension (with doors and panels)				
Width	mm	**620**	**1220**	**620**
Height	mm	2300	2300	**2220**
Depth	mm	**655**	**655**	**655**
Weight	kg	300	400	300

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3.2 Static excitation units for slipring excitation

3.2.1 Options

New: C60 Rated line frequency 60 Hz

The option C60 must be selected, if the line frequency of the armature and auxiliary circuits is 60 Hz instead of 50 Hz. The motor protection circuit breaker of the unit fan is adapted appropriately.

New: L06 Internal generation of 24 V DC

The option L06 includes the internal generation of the 24 V DC supply voltage from the auxiliary 230 V 1 AC, 50/60 Hz voltage supply using a switched-mode power supply.

Y17 Line reactor

The statements of footnote 2) for option Y17 on catalog page 7/7 change as follows:

2) The option Y17 is only available for the excitation units 6RN8011-2SE41-2AA0 and 6RN8011-5SE36-0AA0. With option Y17, the cabinet size can vary depending on the reactor and the continuous rated current can be smaller as given in the following tables.

3.2.2 Selection and ordering data

Table 3-2 Selection and ordering data for slipring excitation (catalog page 7/7); **changes marked in green**

Continuous rated current A	**Supply voltage V**	**Comment**	**Excitation unit** Order No.
500	400 3 AC	On request	**6RN8011**-5SE36-0AA0
500	460 3 AV	Suitable for marine use with type certificate; on request	**6RN8011-7**SE36-0AA0
1050	460 3 AC	–	**6RN8011**-2SE41-2AA0
1050	460 3 AC	Compact	**6RN8011**-3SE41-2AA0
1700	830 3 AC	–	**6RN8011**-0SJ42-0AA0
1800	6903 AC	–	**6RN8011**-1SH42-0AA0
1900	950 3 AC	–	**6RN8011**-6SK42-2AA0
1100	690 3 AC	Fuseless; on request	**6RN8011**-4SH41-1AA0

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3.2.3 Technical data

Table 3-3 Technical data for slipring excitation (catalog page 7/11); **changes marked in green**

Slipring excitation		**6RN8011-...**			
		...-5SE36-0AA0[1]	**...-7SE36-0AA0**[2]	**...-2SE41-2AA0**	**...-3SE41-2AA0**
Continuous rated current	A	**500**	**500**	**1050**	**1050**
Duty cycle 20 s / 280 s	**A**	**600/450**	**600/450**	**1200/1000**	**1200/1000**
Supply voltage	V	3 AC 400	3 AC 460	3 AC 460	3 AC 460
Voltage range	%	–20 ... +15	–20 ... +15	–20 ... +15	–20 ... +15
Rated supply frequency	Hz	50/60	50/60	50/60	50/60
Frequency range	Hz	45 ... 65	45 ... 65	45 ... 65	45 ... 65
Power loss at continuous rated current **(SINAMICS DC MASTER)**	kW	1.8	1.8	**4.3**	**4.3**
Electronics power supply	–	1 AC 230 V, 2 A	**1 AC 230 V, 2 A**	1 AC 230 V, 2 A	1 AC 230 V, 2 A
Fan power supply	–	3 AC 400 V, 50 Hz, **0.23 A** 3 AC 460 V, 60 Hz, **0.26 A**	3 AC 400 V, 50 Hz, **0.23 A** 3 AC 460 V, 60 Hz, **0.26 A**	1 AC 230 V, 50/60 Hz, **0.51/0.72 A**	1 AC 230 V, 50/60 Hz, **0.51/0.72 A**
Max. current demand of the auxiliary supply 1 AC 50/60 Hz 230 V [3]	A	2.5	16	5.1	5.1
Max. current demand of the auxiliary supply 3 AC 50/60 Hz 400 V	A	Plant-specific, typical 50	6	–	–
Cooling air flow rate	m^3/s	**0.15**	**0.15**	**0.28**	**0.28**
Sound pressure level L_{pA} (1 m)	dB(A)	< 73	< 76	< 76	< 76
Measuring surface level L_S(1 m)	dB(A)	17	17	17	16
Cable cross-sections line-side, max. connectable per phase	mm^2 (DIN VDE)	2 x 185	1 x 95	4 x 240	4 x 240
	AWG/MCM (NEC,CEC)	2 x 350 MCM	1 x 3/0 AWG	4 x 500 MCM	4 x 500 MCM
Cable cross-sections motor-side, max. connectable per phase	mm^2 (DIN VDE)	2 x 240	2 x 95	4 x 240	4 x 240
	AWG/MCM (NEC,CEC)	2 x 500 MCM	2 x 3/0 AWG	4 x 500 MCM	4 x 500 MCM
PE connection, max. connection cross-section at enclosure with M12 screw	mm^2 (DIN VDE)	1 x 185	1 x 50	2 x 240	2 x 240
	AWG/MCM (NEC,CEC)	1 x 350 MCM	1 x 1/0 AWG	2 x 500 MCM	2 x 500 MCM
Degree of protection	–	IP23	IP44	IP23	IP23
Dimension (with doors and panels)					
Width	mm	**1220**	**1220**	**620**	**620**
Height	mm	**2310**	**2210**	**2310**	**2310**
Depth	mm	**675**	**675**	**1330**	**675** (compact)
Weight	kg	550	**550**	**900**	450

1) On request

2) Suitable for marine use with type certificate; on request

3) Data without taking options into account

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Table 3-4 Technical data for slipring excitation (catalog page 7/12); **changes marked green**

Slipring excitation		**6RN8011-...**			
		...-0SJ42-0AA0	**...-1SH42-0AA0**	**...-6SK42-2AA0**	**...-4SH41-1AA0**[1]
Continuous rated current	A	1700	1800	1900	**1100**
Duty cycle 20 s / 280 s	**A**	**1900/1500**	**2000/1500**	**2200/1500**	**–**
Supply voltage	V	3 AC 830	3 AC 690	3 AC 950	**3 AC 690**
Voltage range	%	–20 ... +10	–20 ... +10	–20 ... +15	**–20 ... +15**
Rated supply frequency	Hz	50/60	50/60	50/60	**50/60**
Frequency range	Hz	45 ... 65	45 ... 65	45 ... 65	**45 ... 65**
Powerloss at continuous rated current **(SINAMICS DC MASTER)**	kW	8.7	8.2	11.4	**11.4**
Electronics power supply	–	1 AC 230 V, 2 A	1 AC 230 V, 2 A	1 AC 230 V, 2 A	**1 AC 230 V, 2 A**
Fan power supply	–	3 AC 400 V, 50 Hz, **0.95 A** 3 AC 460 V, 60 Hz, 1.25 A	3 AC 400 V, 50 Hz, **0.95 A** 3 AC 460 V, 60 Hz, 1.25 A	3 AC 400 V, 50 Hz, **0.95 A** 3 AC 460 V, 60 Hz, 1.25 A	**3 AC 400 V, 50 Hz, 0.95 A** **3 AC 460 V, 60 Hz, 1.25 A**
Max. current demand of the auxiliary supply 1 AC 50/60 Hz 230 V [2]	A	2.5	2.5	2.5	**2.5**
Max. current demand of the auxiliary supply 3 AC 50/60 Hz 400 V	A	2	2	2	**2**
Cooling air flow rate	m^3/s	0.67	0.67	0.67	**0.67**
Sound pressure level L_{pA} (1 m)	dB(A)	< 87	< 87	< 87	**< 87**
Measuring surface level L_S(1 m)	dB(A)	17	17	17	**17**
Cable cross-sections line-side, max. connectable per phase	mm^2 (DIN VDE)	6 x 240	6 x 240	6 x 240	**6 x 240**
	AWG/MCM (NEC,CEC)	6 x 500 MCM	6 x 500 MCM	6 x 500 MCM	**6 x 500 MCM**
Cable cross-sections motor-side, max. connectable per phase	mm^2 (DIN VDE)	6 x 240	6 x 240	6 x 240	**6 x 240**
	AWG/MCM (NEC,CEC)	6 x 500 MCM	6 x 500 MCM	6 x 500 MCM	**6 x 500 MCM**
PE connection, max. connection cross-section at enclosure with M12 screw	mm^2 (DIN VDE)	3 x 240	3 x 240	3 x 240	**3 x 240**
	AWG/MCM (NEC,CEC)	3 x 500 MCM	3 x 500 MCM	3 x 500 MCM	**3 x 500 MCM**
Degree of protection	–	IP23	IP23	IP23	**IP23**
Dimension (with doors and panels)					
Width	mm	**620**	**620**	**620**	**620**
Height	mm	**2310**	**2310**	**2310**	**2310**
Depth	mm	**1330**	**1330**	**1330**	**1330**
Weight	kg	900	900	900	**900**

1) Fuseless; on request

2) Data without taking options into account

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4 SINAMICS GM150 in IGCT tandem version

The SINAMICS GM150 series has been extended by two water-cooled types in IGCT tandem version.

4.1 Overview

With the expansion of the power range of the SINAMICS GM150, drive applications can be equipped with up to 23 MW for a motor voltage of 6.6 kV.

This is achieved using well-proven SINAMICS GM150 IGCT medium-voltage drives, each with an output voltage of 3.3 kV with a phase offset of approx. 180° feeding an open 6.6 kV motor winding system.

The drive system, comprising two three-level inverters, behaves like a five-level converter and with 17 voltage levels connected to a motor winding generates extremely good sinusoidal motor currents.

Figure 4-1 Block diagram tandem configuration

In the tandem configuration, two basic converter units feed a motor with an open winding system, so that the two converters with nominal voltage 3.3 kV each result in an insulation voltage of 6.6 kV. Hence the tandem version includes different components than the converter units in a basic or parallel circuit. The motor wiring cannot be changed in the tandem configuration.

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Figure 4-2 Equivalent circuit diagram of a tandem circuit

4.2 Options

The same options as for SINAMCIS GM150 in IGCT are available (refer to catalog pages 6/2 to 6/8).

However, the following options are only available on request:

- **B00** (NAMUR terminal strip)
- **E00 to E03** (Control options)
- **L48, L49** (Make-proof grounding switches)
- **L51** (Disconnector at converter output)
- **L52** (Circuit breaker at converter output)
- **L53** (UPS for the power supply of the open-loop and closed-loop control)
- **L72** (Braking Module)
- **M54** (IP54 degree of protection)
- **N13** (Circuit breaker at converter input)
- **Y73** (Braking resistor)

4.3 Selection and ordering data

Table 4-1 SINAMICS GM150 in IGCT tandem version, water cooling

Type rating **kVA**	**Rated output current** **A**	**Order No.**
Output voltage 2 x 3.3 kV		
20000	2 x 1750	**6SL3835-2LR41-8AT0** [1]
24000	2 x 2100	**6SL3835-2LR42-1AT0**

1) On request

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4.4 Technical data

Table 4-2 SINAMICS GM150 in IGCT tandem version, water cooling

Rated data		Order number: 6SL3835-...	
		...-2LR41-8AT0 [1]	...-2LR42-1AT0
Output voltage	kV	2 x 3.3	2 x 3.3
Type rating	kVA	20000	24000
Rated output current	A	2 x 1750	2 x 2100
Shaft output	kW	16700 [2] 19300 [3]	20000 [2] 23100 [3]
	hp	22700 [2] 26200 [3]	27000 [2] 31400 [3]
Input voltage	kV	2 x (2 x 1,7)	2 x (2 x 1,7)
Rated input current	A	2 x (2 x 1570)	2 x (2 x 1970)
Power loss	kW	approx. 2 x 110	approx. 2 x 110
Efficiency	%	99.1	99.1
Typ. current demand of the auxiliary supply 230 V 1 AC 50/60 Hz	A	6	6
Max. current demand of the auxiliary supply 400 V 3 AC 50/60 Hz	A	20	20
Precharging current demand, briefly for approx. 25 s	A	40	40
Raw water flow rate	l/min	417	417
Deionized water requirement, approx.	l	170	170
Sound pressure level L_{pA} (1 m)	dB(A)	77	77
Measuring surface level L_S(1 m)	dB(A)	22	22
Cable cross-sections, line-side, max. connectable per phase	mm^2 (DIN VDE)	6 x 240	6 x 240
	AWG/MCM (NEC,CEC)	6 x 500 MCM	6 x 500 MCM
Cable cross-sections, motor-side, max. connectable per phase	mm^2 (DIN VDE)	6 x 240	6 x 240
	AWG/MCM (NEC,CEC)	6 x 500 MCM	6 x 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw	mm^2 (DIN VDE)	2 x 3 x 120	2 x 3 x 120
	AWG/MCM (NEC,CEC)	2 x 3 x 250 MCM	2 x 3 x 250 MCM
Degree of protection	—	IP43	IP43
Dimensions			
Width	mm	9400	9400
Height	mm	2830	2830
Depth	mm	1600	1600
Weight	kg	9900	9900

1) On request

2) Power for operation of induction motors with typical power factor $(\cos \varphi)_{motor}$ = 0.88 and efficiency η_{motor} = 0.96

3) Power for operation of synchronous motors with typical power factor $(\cos \varphi)_{motor}$ = 1.0 and efficiency η_{motor} = 0.96

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Siemens AG
Industry Sector
Drive Technologies Division
Large Drives
Postfach 4743
90025 NÜRNBERG
DEUTSCHLAND

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- Catalog D 84.1 Three-phase Induction Motors H-compact, H-compact PLUS (PDF format)

Hardware and software requirements:

- Intel Pentium 1 GHz or higher
- RAM, min. 512 Mbyte
- Screen resolution 1024 × 768 Pixel
- CD-ROM-drive, at least 16 x
- Windows XP/Vista
- Acrobat Reader 7.0 and higher
- MS Internet Explorer V6.0 (SP2)

Start
Insert the CD-ROM into the CD-ROM drive.
The program starts automatically.
If the AutoRun function is not activated in your system, start file start.hta from the CD-ROM using the Windows Explorer.

Note
Installation is not necessary to view the information on this CD-ROM. This does not apply, however, when using dimensional drawings in DXF format.

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SINAMICS Drives
SINAMICS GM150
SINAMICS SM150
Medium-Voltage Converters

Catalog D 12 · 2012

The products and systems described in this catalog are manufactured/distributed under application of a certified quality management system in accordance with DIN EN ISO 9001 (Certified Registration No. 002241 QM UM). The certificate is recognized by all IQNet countries.

Supersedes:
Catalog D 12 · 2009

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Answers for industry.

Siemens Industry answers the challenges in the manufacturing and the process industry as well as in the building automation business. Our drive and automation solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) are employed in all kinds of industry. In the manufacturing and the process industry. In industrial as well as in functional buildings.

Siemens offers automation, drive, and low-voltage switching technology as well as industrial software from standard products up to entire industry solutions. The industry software enables our industry customers to optimize the entire value chain – from product design and development through manufacture and sales up to after-sales service. Our electrical and mechanical components offer integrated technologies for the entire drive train – from couplings to gear units, from motors to control and drive solutions for all engineering industries. Our technology platform TIP offers robust solutions for power distribution.

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Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.

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Setting standards in productivity and competitiveness.

Totally Integrated Automation.

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TIA is characterized by its unique continuity.

It provides maximum transparency at all levels with reduced interfacing requirements – covering the field level, production control level, up to the corporate management level. With TIA you also profit throughout the complete life cycle of your plant – starting with the initial planning steps through operation up to modernization, where we offer a high measure of investment security resulting from continuity in the further development of our products and from reducing the number of interfaces to a minimum.

The unique continuity is already a defined characteristic at the development stage of our products and systems.

The result: maximum interoperability – covering the controller, HMI, drives, up to the process control system. This reduces the complexity of the automation solution in your plant. You will experience this, for example, in the engineering phase of the automation solution in the form of reduced time requirements and cost, or during operation using the continuous diagnostics facilities of Totally Integrated Automation for increasing the availability of your plant.

Thanks to Totally Integrated Automation, Siemens provides an integrated basis for the implementation of customized automation solutions – in all industries from inbound to outbound.

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Integrated power distribution from one source.

Totally Integrated Power.

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Electrical power distribution requires integrated solutions. Our answer: Totally Integrated Power (TIP). This includes tools and support for planning and configuration and a complete, optimally harmonized product and system portfolio for integrated power distribution from medium-voltage switchgear right to socket outlets.

The power distribution products and systems can be interfaced to building or industrial automation systems (as part of Total Building Solutions or Totally Integrated Automation) via communication capable circuit breakers and modules, allowing the full potential for optimization that an integrated solution offers to be exploited throughout the product cycle – from planning right through to installation and operation.

Thanks to a comprehensive energy management system, power flows can be made transparent and the energy consumption of individual loads can be calculated and allocated. Building operators can thus identify power-intensive loads and implement effective optimization measures. With its products and systems, Totally Integrated Power forms the basis for this functionality and guarantees greater cost-efficiency in industrial applications, infrastructure and buildings.

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Application areas of the SINAMICS drive family

Application

SINAMICS is the family of drives from Siemens designed for industrial machine and plant construction. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry
- Complex single-motor drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems
- Drive line-ups in textile, plastic film, and paper machines, as well as in rolling mill plants
- High-precision servo drives for the manufacture of wind turbines
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines

Product variants

Depending on the application, the SINAMICS range offers the ideal variant for any drive task.

- SINAMICS G is designed for standard applications with induction motors. These applications have less stringent requirements regarding the dynamic performance of the motor speed.
- SINAMICS S handles demanding drive tasks with synchronous and induction motors and fulfills stringent requirements regarding
  - the dynamic performance and accuracy
  - integration of extensive technological functions in the drive control system.
- SINAMICS DCM is the DC drive belonging to the SINAMICS family. As a result of its expandability across the board, it addresses both basic as well as demanding applications in drive technology and in complementary markets.

Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Common hardware and software components, as well as standardized tools for design, configuration and commissioning tasks, ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks without system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering engineering, data management and communication at the automation level, result in extremely cost-effective solutions based on SIMOTION, SINUMERIK and SIMATIC control systems.

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SINAMICS as part of the Siemens modular automation system

Quality management according to DIN EN ISO 9001

SINAMICS is able to meet the highest quality requirements. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

Of course, our quality management system is certified by an independent authority in accordance with EN ISO 9001.

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The SINAMICS drive family

System properties

The SINAMICS range is characterized by the following system properties:

- Standard functionality based on a single platform concept
- Standardized engineering
- High degree of flexibility and combination capability
- Broad power range
- Designed for global use
- SINAMICS Safety Integrated
- Higher efficiency and effectiveness
- High energy efficiency
- Versatile interfacing facilities to higher-level controllers
- Totally Integrated Automation

Application areas

Tailored to suit different application areas, the SINAMICS range encompasses the following products:

AC low-voltage converters (line supply < 1000 V)

- **SINAMICS G110**
  - The versatile drive for low power ratings
- **SINAMICS G120P**
  - The specialist for pumps, fans, and compressors
- **SINAMICS G120**
  - The modular single-motor drive for low up to medium power ratings
- **SINAMICS G110D**
  - The distributed, compact single-motor drive in a high degree of protection for basic applications
- **SINAMICS G120D**
  - The distributed, modular single-motor drive in a high degree of protection for sophisticated applications
- **SINAMICS G130** and **SINAMICS G150**
  - The universal drive solution for single-motor drives with a high power rating
- **SINAMICS S110**
  - The basic positioning drive for single-axis applications
- **SINAMICS S120**
  - The flexible, modular drive system for demanding drive tasks
- **SINAMICS S150**
  - The drive solution for demanding single-motor drives with a high power rating

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Common Engineering Tools

SIZER for Siemens Drives – for simple planning and configuration

STARTER – for fast commissioning, optimization and diagnostics

Application areas *(continued)*

DC converter (line supply voltage < 1000 V)

- **SINAMICS DCM**
  - The scalable drive system for basic and demanding applications

AC medium-voltage converters (line supply voltage > 1000 V)

- **SINAMICS GM150**
  - The universal drive solution for single-motor drives
- **SINAMICS SM150**
  - The drive solution for demanding single-motor and multimotor drives
- **SINAMICS GL150**
  - The drive solution for synchronous motors up to 120 MW
- **SINAMICS SL150**
  - The drive solution for slow speed motors with the highest torques and overloads

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The members of the SINAMICS family

1

Overview

SINAMICS G – The efficient drives

SINAMICS G110	SINAMICS G120C	SINAMICS G120P	SINAMICS G120
The versatile single drive for low power ratings	*The compact drive with high power density*	*The specialist for pumps, fans, and compressors*	*The modular single drive for low to medium power ratings*
Main applications			
Machines and plants in industrial and commercial applications	For machine manufacturers and distributors in industrial and commercial applications (secondary drive in production machines or generally for water/waste water, automotive)	Machines and plants in industrial and commercial applications (heating, air conditioning, ventilation, water/waste water, process industry, food and beverage industry)	Machines and plants in industrial and commercial applications (machinery construction, automotive, textiles, chemical industry, printing, steel)
Application examples			
• Simple pumps and fans • Auxiliary drives • Conveyor systems • Billboards • Door/gate operating mechanisms	• Mixers • Extruders • Simple pumps, fans, compressors • Vibrator motors • Simple wire drawing machines	• Pumps and fans • Compressors	• Pumps and fans • Compressors • Centrifuges • Conveyor systems
Highlights			
• Compact • Can be flexibly adapted to different applications • Simple and fast commissioning • Clear terminal layout • Optimum interaction with SIMATIC and LOGO!	• Compact • High power density • Simple and fast commissioning • USB port • Plug-in terminal strips • Standard commissioning with SD card • Optimum interaction with SIMOTION and SIMATIC	• High degree of protection IP54 • Integrated pumping, ventilation, compressing functions • Reduced line harmonic distortions • Optimum energy management through innovative technology • Easy-to-use application wizards • Flexible and modular	• Modular • Can be flexibly expanded • Simple and fast commissioning • Regenerative feedback • Innovative cooling concept • Optimum interaction with SIMOTION and SIMATIC
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Overview

SINAMICS G – The efficient drives

SINAMICS G110D	SINAMICS G120D	SINAMICS G130, SINAMICS G150
The distributed single drive for basic solutions	*The distributed single drive for high-performance solutions*	*The universal drive solution for single drives with high output ratings*
Main applications		
Horizontal conveyor applications in industrial environments, main focus on distribution and logistics in airports; generally suitable for basic conveyor-related tasks with local control or connected to a bus via AS- Interface	Conveyor drive applications in industrial environments, main focus on the automotive industry; also suitable for high-performance applications e.g. at airports and in the food, beverage and tobacco industry (without surfactants)	Machines and plants in the process and production industry, water/waste, power stations, oil and gas, petrochemicals, chemical raw materials, paper, cement, stone, steel
Application examples		
• Conveyor systems • Airports • Distribution logistics	• Conveyor systems • Electric monorail system in distribution logistics	• Pumps and fans • Compressors • Extruders and mixers • Mills
Highlights		
• Low profile design with standard drilling dimensions (standard footprint) in IP65 degree of protection • Simple and fast commissioning • Versions with and without a maintenance switch • Optional key-operated switch • AS-Interface with bus parameterization • Quick stop function • Integrated brake control, 180 V DC • Optimum interaction with SIMATIC and LOGO!	• Low profile design with standard drilling dimensions (standard footprint) in IP65 degree of protection • Modular • Can be flexibly expanded • Simple and fast commissioning • Regenerative feedback • Optimum interaction with SIMOTION and SIMATIC	• Space-saving • Low noise • Simple and fast commissioning • SINAMICS G130: Modular components • SINAMICS G150: Ready-to-connect cabinet unit • Optimum interaction with SIMATIC
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The members of the SINAMICS family

Overview

SINAMICS S – The flexible drives

SINAMICS S110	SINAMICS S120	SINAMICS S150
The specialist for simple positioning tasks	*The flexible, modular drive system for demanding drive tasks*	*The drive solution for sophisticated single drives with high output ratings*
Main applications		
Machines and plants in industrial applications, where machine axes should be quickly and precisely positioned in the simplest possible way.	Machines and plants in industrial applications (packaging, plastics, textile, printing, wood, glass, ceramics, presses, paper, lifting equipment, semiconductors, automated assembly and testing equipment, handling, machine tools)	Machines and plants in the process and production industry, food, beverages and tobacco, automotive and steel industry, mining/open-cast mining, shipbuilding, lifting equipment, conveyors
Application examples		
• Handling equipment • Feed and withdrawal devices • Stacking units • Automatic assembly machines • Laboratory automation • Metalworking • Woodworking, glass and ceramic industries • Plastics processing machines • Tracking systems for solar technology	• Motion control applications (positioning, synchronous operation) • Numerical control, interpolating motion control • Converting • Technological applications	• Test stand drives • Centrifuges • Elevators and cranes • Cross cutters and shears • Conveyor belts • Presses • Cable winches
Highlights		
• For universal use • Flexible and modular • Scalable in terms of power rating, functionality • Simple and fast commissioning, auto-configuration • Wide range of motors • Optimum interaction with SIMATIC	• For universal use • Flexible and modular • Scalable in terms of power rating, functionality, number of axes, performance • Simple and fast commissioning, auto-configuration • Wide range of motors • Optimum interaction with SIMOTION, SINUMERIK and SIMATIC	• Four-quadrant operation as standard • High control accuracy and dynamic response • Minimum harmonic effects on the supply system, considerably lower than the limits specified in IEEE 519 THD • Tolerant to line voltage fluctuations • Simple and fast commissioning • Ready-to-connect cabinet unit • Optimum interaction with SIMATIC
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Overview

SINAMICS medium-voltage converters

SINAMICS GM150	SINAMICS SM150	SINAMICS GL150	SINAMICS SL150
The drive solution for single-motor and multi-motor drives in the medium-voltage range	*The drive solution for demanding single-motor and multi-motor drives*	*The drive solution for synchronous motors up to 120 MW*	*The drive solution for slow speed motors with highest torques and overloads*
Main applications			
Machines and plants in the process industry	Plants and machines in the steel, mining and engineering sector	Plants and machines in the process industry, especially in the oil, gas and petrochemicals sectors	Plants and machines in the basic materials industry, especially in the steel and mining sectors
Application examples			
• Pumps and fans • Compressors • Extruders and mixers • Mills • Marine drives	• Hot and cold rolling mill stands • Mine hoists • Test stand drives • Ore conveyor belts	• Compressors • Pumps and fans • Extruders and kneaders • Marine drives • Blast furnace blowers	• Hot rolling mill roughing stands • Mine hoists • Ore and cement mills • Excavators
Highlights			
• Space-saving • Simple and fast commissioning • Ready-to-connect cabinet units • Optimum interaction with SIMATIC • Liquid- and air-cooled version	• Four-quadrant operation as standard • High efficiency and minimum load on the motor • High control accuracy and dynamic performance • Almost free of line-current harmonics • Option of reactive power compensation • Simple and fast commissioning • Ready-to-connect cabinet unit • Optimum interaction with SIMATIC • Liquid-and air-cooled version	• Compact design and high power density • Easy operation and monitoring • Extremely rugged, reliable and almost maintenance-free • Two directions of rotation by reversing the rotating field • Capable of seamless integration into higher-level automation systems • Liquid- and air-cooled version	• Low output frequency/ motor speed • High short-time overload capability • Four-quadrant operation as standard • Extremely rugged, reliable and almost maintenance-free • High efficiency • Capable of seamless integration into higher-level automation systems • Liquid- and air-cooled version
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Overview

SINAMICS DCM converters

SINAMICS DCM

The scalable drive system for basic and demanding applications

Main applications

Machines and plants in the industrial environment (steel/aluminum, plastics, printing, paper, cranes, mining/open-cast mining, oil and gas, excitation equipment) in the new plant and retrofit businesses

Application examples

- Rolling mills
- Cross cutters and shears
- Wire-drawing machines
- Extruders and kneaders
- Presses
- Elevators and cranes
- Cableways and lifts
- Mine hoists
- Test stand drives

Highlights

- PROFIBUS as standard, PROFINET optional
- Variance of the Control Units
- 24 V DC electronics power supply
- Power unit isolated with respect to ground
- Free function blocks and Drive Control Chart
- Expandable functionality using SINAMICS components
- Single-phase connection possible
- Coated modules and nickel-plated copper busbars
- Wide temperature range

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Overview

The SINAMICS GM150 and SINAMICS SM150 converters are the expansion of the SINAMICS drive family in the medium voltage range. They are supplied as ready-to-connect cabinet units.

SINAMICS GM150

SINAMICS GM150 converters are designed as an individual drive for applications with quadratic and constant load characteristics without regenerative feedback.

Typical applications:

- Pumps and fans
- Compressors
- Extruders and mixers
- Mills
- Marine drives

The inverters on the motor side (Motor Modules) have IGBT power semiconductors in the lower power range to 13 MVA and IGCT power semiconductors in the upper power range from 10 MVA to 21 MVA.

SINAMICS SM150

SINAMICS SM150 converters are designed for demanding single and multi-motor applications and meet the following requirements:

- High dynamic response
- Operation at low frequency
- Line power factor = 1.0 (can be freely selected)
- Four-quadrant operation

Typical applications:

- Roller drives (cold, hot)
- Hoisting drives
- Test stands
- Belt systems

Both the line-side infeed/regenerative feedback units (Active Line Modules) and the motor-side inverters are either equipped with IGBT or IGCT power semiconductors.

	SINAMICS GM150 IGBT		SINAMICS GM150 IGCT		SINAMICS SM150 IGBT	SINAMICS SM150 IGCT
Line Module (rectifier on mains side)						
Basic Line Module, 12-pulse (two-quadrant operation)	Standard		Standard		–	–
Basic Line Module, 24-pulse (two-quadrant operation)	Option Standard for a parallel circuit configuration		Option Standard for a parallel circuit configuration		–	–
Basic Line Module, 36-pulse (two-quadrant operation)	–		Standard for a triple parallel circuit configuration		–	–
Active Line Module (four-quadrant operation)	–		–		Standard	Standard
Motor Module (rectifier on motor side)						
Voltage range	2.3 ... 4.16 kV		3.3 kV		3.3 and 4.16 kV	3.3 kV
Power range (typ.)	1 ... 13 MVA		10 ... 21 MVA		3.4 ... 7.2 MVA	5 ... 31.5 MVA
Cooling method						
• Air cooling	Standard		–		Standard	–
• Water cooling	Standard		Standard		Standard	Standard
Control modes	Encoderless	With encoder	Encoderless	With encoder	Standard: With encoder	Standard: With encoder
• Induction motor	Standard	Standard	Standard	Standard	Standard	Standard
• Synchronous motor, separately excited with slipring excitation	On request	Option	On request	Option	Option	Option
• Synchronous motor, separately excited with brushless reverse field excitation	On request	On request	On request	On request	On request	On request
• Synchronous motor, permanently excited	On request	On request	On request	Option	On request	Option
Sine-wave filter	Option		–		On request	–
DC bus configuration with several Motor Modules on one common DC bus	–		–		–	Standard

Benefits

- Low-cost: all the way from planning to service
- Simple and uncomplicated in every regard: engineering, integration, operation and diagnostics
- High availability: robust and reliable components, easy installation, high service-friendliness

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Notes

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SINAMICS GM150 in IGBT version

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version

2

Overview

SINAMICS GM150 as IGBT version (air-cooled)

SINAMICS GM150 converters as IGBT version can be optimally combined with Siemens converter motors. Sine-wave filters are not required in this case. This ensures that the drive solution is particularly cost-effective, compact and efficient.

With the sine-wave filter available as an optional extra, the converters offer the best conditions on the market for the operation of line motors. This makes them ideally suited for the retrofitting of existing systems from fixed-speed drives to speed-controlled drives.

SINAMICS GM150 converters as IGBT version offer economic drive solutions that can be matched to customers' specific requirements by adding from the wide range of available components and options.

IGBT converters are available for the following voltages and outputs:

Rated output voltage	Type rating with air cooling	Type rating with water cooling
2.3 kV	1.0 ... 3.2 MVA	2.0 ... 4.0 MVA
3.3 kV	1.0 ... 8.0 MVA	2.0 ... 10.3 MVA
4.16 kV	1.3 ... 10.1 MVA	2.0 ... 13.0 MVA

Global use

SINAMICS GM150 converters as IGBT version are manufactured to international standards and regulations, making them ideally suited for global use. These converters are also available in a UL-listed version and in a ship-going form (meeting the requirements of all major classification organizations).

Benefits

- Compact design and high flexibility in configuration ensures easy plant integration
- Easy operation and monitoring on the convenient operator panel
- Easy and reliable operation through integrated maintenance functions: the converter signals early and automatically if maintenance is required or components need to be exchanged
- High robustness and reliability due to the use of HV-IGBT technology and fuseless installation combined with intelligent reaction to external disturbances
- Can be easily integrated into automation solutions due to PROFIBUS interface supplied as standard and various analog and digital interfaces
- High level of service-friendliness through innovative power section design with plug-in power cards and easy access to all components

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Design

SINAMICS GM150 converters in the IGBT version are available with a 12-pulse or 24-pulse Basic Line Module.

The 12-pulse version is standard for smaller output ratings with voltages of 2.3 kV, 3.3 kV and 4.16 kV.

For higher output power ratings, two Basic Line Modules with a common DC link or two Line Modules (24-pulse Basic Line Modules) are connected in parallel.

The 24-pulse Basic Line Module is optionally available for smaller output ratings with voltages of 2.3 kV, 3.3 kV and 4.16 kV.

HV-IGBT power semiconductors are used in the Motor Modules – they are mounted on plug-in Power cards that are simple to replace.

Both line and motor connections can be optionally realized from underneath or above.

The converter cabinet unit consists of a section for the Basic Line Module, a section for the Motor Module and the control section.

SINAMICS GM150 as air-cooled IGBT version, internal design

Block diagram

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Design

The following wiring versions are available for SINAMICS GM150 as IGBT version.

Basic circuit, 12-pulse infeed, diode rectifier in the Basic Line Module connected in series

24-pulse infeed by connecting two Basic Line Modules in parallel (option **N15**), diode rectifier connected in parallel in the Basic Line Module

Increased power rating by connecting Basic Line Modules and Motor Modules in parallel on a common DC bus for 3.3 kV and 4.16 kV (24-pulse infeed as standard), diode rectifier connected in parallel in the Basic Line Module

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Design

Basic circuit with sine-wave filter for operating line motors (option **Y15**), diode rectifier connected in series in the Basic Line Module

24-pulse infeed by connecting two Basic Line Modules in parallel (option **N15**), diode rectifier connected in parallel in the Basic Line Module here, with sine-wave filter for operating line motors (option **Y15**)

Parallel circuit with sine-wave filter for operating line motors for 3.3 kV and 4.16 kV (option **Y15**), diode rectifier connected in parallel in the Basic Line Module

Note: The motor cables are combined in the motor terminal box.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version

Function

Characteristic features

SINAMICS GM150 in IGBT version		
Line Module (rectifier on mains side)		
Basic Line Module, 12-pulse (two-quadrant operation)	Standard	
Basic Line Module, 24-pulse (two-quadrant operation)	Option Standard for a parallel circuit configuration	
Motor Module (rectifier on motor side)		
Voltage range	2.3 ... 4.16 kV	
Power range (typ.)	1 ... 13 MVA	
Cooling method		
• Air cooling	Standard	
• Water cooling	Standard	
Control modes	Without encoder	With encoder
• Induction motor	Standard	Standard
• Synchronous motor, separately excited, with slip-ring excitation	On request	Option
• Synchronous motor, separately excited, with brushless (RG) excitation system	On request	On request
• Synchronous motor, separately excited	Option	On request
Sine-wave filter	Option	

Software and protection functions

SINAMICS GM150 in IGBT version	Description
Closed-loop control	The motor-side closed-loop control is realized as a field-oriented closed-loop vector control that can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamic performance of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely independently of each other. Prescribed torques can thus be observed and limited accurately. In the speed range from 1:10, the field-oriented closed-loop control does not require an actual speed value encoder. An actual speed value encoder is required in the following scenarios: • High dynamics requirements • Torque control/constant torque drives with a control range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal strip. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all of the interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with variable smoothing times in the lower and upper speed ranges, improves the control response and therefore prevents mechanical overloading of the drive train. The ramp-down ramps can be parameterized separately for emergency stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Power supply failures are bridged to the extent permitted by the kinetic energy of the drive train. The speed drops depending on the moment of inertia and the load torque. The current speed setpoint is resumed when the power supply returns. This function can cause fast load cycles changes which may have a negative effect on the infeed line (in particular on weak lines e.g. on ships).
Automatic restart (option L32)	The automatic restart switches the drive on again when the power is restored after a power failure or a general fault, and ramps up to the current speed setpoint.
Flying restart	The flying restart function permits smooth connection of the converter to a rotating motor.
Diagnostics functions	• Self-diagnosis of control hardware • Non-volatile memory for reliable diagnosis when the power supply fails • Monitoring of HV IGBTs with individual messages for each slot • User-friendly on-site operator panel with plain text messages
Operating hours and switching cycle counter	The operating hours of the non-redundant fans, which are located on the roof section of the cabinets, are detected and logged so that preventive maintenance can be performed or equipment replaced as a preventive measure. The switching cycles of the circuit breaker are recorded and added together, to form the basis of preventive maintenance work.

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Software and protection functions

SINAMICS GM150 in IGBT version	Description
Detecting the actual motor speed (option)	The SMC30 encoder module can be used to record the actual motor speed. The signals from the rotary pulse encoder are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.
Operator protection	The cabinet doors of the power units are fitted with electromagnetic locks. This prevents the cabinet doors being opened while hazardous voltages are connected inside the cabinet.
EMERGENCY-OFF button	The converters are equipped as standard with an EMERGENCY-OFF button with protective collar which is fitted in the cabinet door. The contacts of the button are connected in parallel to the terminal strip so they can be integrated in a protection concept on the plant side. EMERGENCY-OFF stop category 0 is set as standard for an uncontrolled shutdown (DIN EN 60204-1/VDE 0113-1 (IEC 60204-1)). The function includes voltage disconnection of the converter output through the circuit breaker. The motor coasts in the process. EMERGENCY-STOP category 1 is optionally available for a controlled shutdown (option **L60**).
Insulation monitoring	The converters feature insulation monitoring of the complete electrical circuit from the secondary side of the transformer to the stator windings of the motor.
Monitoring of the peripherals	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available.
Thermal overload protection	An alarm message is issued first when the overtemperature threshold is reached. If the temperature rises further, either a shutdown is carried out or automatic influencing of the output current so that a reduction in the thermal load is achieved. Following elimination of the cause of the fault (e.g. improvement in the ventilation), the original operating values are automatically resumed. For instance, for air-cooled converters and when filter mats are used, the amount of pollution of the filter mats is monitored by measuring the differential pressure which is then signaled. In the case of water-cooled converters, the water temperature and flow rate are recorded at several points in the cooling circuit and evaluated. Extensive self-diagnostic functions signal faults and therefore protect the converter.
Grounding switch (option)	If grounding on the infeed or motor side is required for safety and protection reasons, a motorized grounding switch can be ordered. For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.
Capacitor tripping device (option)	For applications in which the existing circuit breaker has no undervoltage coil and cannot be retrofitted there are capacitor tripping devices for 110 V to 120 V DC and for 220 V DC. The capacitor tripping device ensures that the circuit breaker on the plant side can still be reliably opened even if there is a power failure or the normal OFF command is not effective, e.g. because of a wire break.

AOP30 operator panel

The AOP30 operator panel is fitted into the cabinet door of the SINAMICS GM150 to enable operation, monitoring and commissioning.

It has the following features and characteristics:

- Graphical LCD display with backlighting for plain-text display and a bar display of process variables
- LEDs for displaying the operational status
- Help function describing causes of and remedies for faults and alarms
- Membrane keyboard with keypad for operational control of a drive
- Local/remote switchover to select the operator control location (priority assigned to operator panel or customer's terminal strip/PROFIBUS)
- Numeric keypad for input of setpoint or parameter values
- Function keys for prompted navigation in the menu
- Two-stage safety strategy to protect against accidental or unauthorized changes to settings. The keyboard lock disables operation of the drive from the operator panel, so that only parameter values and process variables can be displayed. A password can be used to prevent the unauthorized modification of converter parameters.

The operator panel languages – English, German, Spanish and Chinese – are stored on the CompactFlash card of the Control Unit.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version

2

Selection and ordering data

Type rating	Shaft output		Rated output current	**SINAMICS GM150 as IGBT version, air cooling, without sine-wave filter**	Circuit version (page 2/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
1000	820	1000	250	**6SL3810-2LM32-5AA0**	①
1200	1000	1250	300	**6SL3810-2LM33-0AA0**	①
1400	1150	1500	350	**6SL3810-2LM33-5AA0**	①
1600	1300	1750	400	**6SL3810-2LM34-0AA0**	①
1800	1500	2000	460	**6SL3810-2LM34-6AA1**	①
2100	1750	2400	530	**6SL3810-2LM35-3AA1**	①
2400	2000	2750	600	**6SL3810-2LM36-0AA0**	①
2700	2250	3100	700	**6SL3810-2LM37-0AA1**	①
3200	2650	3600	800	**6SL3810-2LM38-0AA1**	①
Output voltage 3.3 kV					
1000	850	1000	180	**6SL3810-2LN31-8AA0**	①
1300	1050	1250	220	**6SL3810-2LN32-2AA0**	①
1500	1250	1500	260	**6SL3810-2LN32-6AA0**	①
1700	1400	2000	300	**6SL3810-2LN33-0AA0**	①
2000	1650	2250	350	**6SL3810-2LN33-5AA0**	①
2300	1900	2500	400	**6SL3810-2LN34-0AA0**	①
2600	2150	3000	460	**6SL3810-2LN34-6AA1**	①
3000	2500	3380	530	**6SL3810-2LN35-3AA1**	①
3400	2850	3750	600	**6SL3810-2LN36-0AA0**	①
4000	3300	4500	700	**6SL3810-2LN37-0AA1**	①
4600	3800	5000	800	**6SL3810-2LN38-0AA1**	①
5300	4450	6200	2 × 465	**6SL3810-2LN38-8AA1**	③
6300	5300	7000	2 × 550	**6SL3810-2LN41-1AA0**	③
7100	6000	8000	2 × 625	**6SL3810-2LN41-2AA1**	③
8000	6700	9500	2 × 700	**6SL3810-2LN41-4AA1**	③
Output voltage 4.16 kV					
1300	1000	1500	180	**6SL3810-2LP31-8AA0**	①
1600	1300	1750	220	**6SL3810-2LP32-2AA0**	①
1900	1550	2000	260	**6SL3810-2LP32-6AA0**	①
2200	1800	2500	300	**6SL3810-2LP33-0AA0**	①
2500	2100	3000	350	**6SL3810-2LP33-5AA0**	①
2900	2400	3250	400	**6SL3810-2LP34-0AA0**	①
3300	2800	3800	460	**6SL3810-2LP34-6AA1**	①
3800	3100	4100	530	**6SL3810-2LP35-3AA1**	①
4300	3600	5000	600	**6SL3810-2LP36-0AA0**	①
5000	4150	5650	700	**6SL3810-2LP37-0AA1**	①
5800	4800	6600	800	**6SL3810-2LP38-0AA1**	①
6700	5650	7600	2 × 465	**6SL3810-2LP38-8AA1**	③
7900	6600	9000	2 × 550	**6SL3810-2LP41-1AA0**	③
9000	7600	10250	2 × 625	**6SL3810-2LP41-2AA1**	③
10100	8500	11500	2 × 700	**6SL3810-2LP41-4AA1**	③

Type rating	Shaft output		Rated output current	**SINAMICS GM150 as IGBT version, air cooling, with sine-wave filter**		Circuit version (page 2/5)
kVA	kW	hp	A	Order No.		Fig. No.
Output voltage 2.3 kV						
850	700	900	210	**6SL3810-2LM32-5AA0-Z**	**Y15**	④
1000	800	1000	250	**6SL3810-2LM33-0AA0-Z**	**Y15**	④
1150	950	1250	290	**6SL3810-2LM33-5AA0-Z**	**Y15**	④
1300	1100	1500	330	**6SL3810-2LM34-0AA0-Z**	**Y15**	④
1450	1200	1600	390	**6SL3810-2LM34-6AA1-Z**	**Y15**	④
1650	1350	1850	420	**6SL3810-2LM35-3AA1-Z**	**Y15**	④
2000	1650	2250	500	**6SL3810-2LM36-0AA0-Z**	**Y15**	④
–	–	–	–	–	–	–
–	–	–	–	–	–	–
Output voltage 3.3 kV						
850	700	900	150	**6SL3810-2LN31-8AA0-Z**	**Y15**	④
1100	900	1150	190	**6SL3810-2LN32-2AA0-Z**	**Y15**	④
1250	1050	1250	220	**6SL3810-2LN32-6AA0-Z**	**Y15**	④
1450	1200	1500	250	**6SL3810-2LN33-0AA0-Z**	**Y15**	④
1700	1400	1750	300	**6SL3810-2LN33-5AA0-Z**	**Y15**	④
1950	1600	2000	340	**6SL3810-2LN34-0AA0-Z**	**Y15**	④
2350	1850	2500	410	**6SL3810-2LN34-6AA1-Z**	**Y15**	④
2600	2100	2850	440	**6SL3810-2LN35-3AA1-Z**	**Y15**	④
2900	2450	3250	510	**6SL3810-2LN36-0AA0-Z**	**Y15**	④
–	–	–	–	–	–	–
–	–	–	–	–	–	–
4750	3650	5100	830	**6SL3810-2LN38-8AA1-Z**	**Y15**	⑥
5350	4500	6000	940	**6SL3810-2LN41-1AA0-Z**	**Y15**	⑥
–	–	–	–	–	–	–
–	–	–	–	–	–	–
Output voltage 4.16 kV						
1100	900	1250	150	**6SL3810-2LP31-8AA0-Z**	**Y15**	④
1350	1150	1500	190	**6SL3810-2LP32-2AA0-Z**	**Y15**	④
1600	1300	1750	220	**6SL3810-2LP32-6AA0-Z**	**Y15**	④
1850	1550	2000	260	**6SL3810-2LP33-0AA0-Z**	**Y15**	④
2100	1750	2250	290	**6SL3810-2LP33-5AA0-Z**	**Y15**	④
2450	2000	2750	340	**6SL3810-2LP34-0AA0-Z**	**Y15**	④
2950	2400	3250	410	**6SL3810-2LP34-6AA1-Z**	**Y15**	④
3250	2600	3600	480	**6SL3810-2LP35-3AA1-Z**	**Y15**	④
3600	3000	4000	500	**6SL3810-2LP36-0AA0-Z**	**Y15**	④
–	–	–	–	–	–	–
–	–	–	–	–	–	–
6000	5100	6800	830	**6SL3810-2LP38-8AA1-Z**	**Y15**	⑥
6650	5500	7500	920	**6SL3810-2LP41-1AA0-Z**	**Y15**	⑥
–	–	–	–	–	–	–
–	–	–	–	–	–	–

Special version **"–Z"**

The order code **Y15** (sine-wave filter) must be additionally specified and requires plain text
(see Description of the options, Page 6/42).

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Selection and ordering data

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, water cooling, without sine-wave filter	Circuit version (page 2/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
2000	1650	2250	500	**6SL3815-2LM35-0AA0**	①
2200	1800	2500	550	**6SL3815-2LM35-5AA0**	①
2400	2000	2750	600	**6SL3815-2LM36-0AA1**	①
2600	2150	2950	660	**6SL3815-2LM36-6AA1**	①
2900	2450	3250	740	**6SL3815-2LM37-4AA0**	①
3200	2650	3500	800	**6SL3815-2LM38-0AA0**	①
3500	2900	3850	880	**6SL3815-2LM38-8AA1**	①
4000	3300	4400	1000	**6SL3815-2LM41-0AA1**	①
Output voltage 3.3 kV					
2000	1650	2250	350	**6SL3815-2LN33-5AA0**	①
2300	1900	2500	400	**6SL3815-2LN34-0AA0**	①
2600	2150	3000	450	**6SL3815-2LN34-5AA0**	①
2900	2400	3250	500	**6SL3815-2LN35-0AA0**	①
3100	2650	3500	550	**6SL3815-2LN35-5AA0**	①
3400	2800	3800	600	**6SL3815-2LN36-0AA1**	①
3800	3150	4200	660	**6SL3815-2LN36-6AA1**	①
4200	3500	4500	740	**6SL3815-2LN37-4AA0**	①
4600	3800	5000	800	**6SL3815-2LN38-0AA0**	①
5100	4250	6000	880	**6SL3815-2LN38-8AA1**	①
5700	4700	6150	1000	**6SL3815-2LN41-0AA1**	①
6300	5300	7000	2 × 550	**6SL3815-2LN41-1AA1**	③
6800	5600	7400	2 × 600	**6SL3815-2LN41-2AA1**	③
7400	6200	8000	2 × 650	**6SL3815-2LN41-3AA0**	③
8000	6700	9000	2 × 700	**6SL3815-2LN41-4AA0**	③
9100	7600	10200	2 × 800	**6SL3815-2LN41-6AA1**	③
10300	8600	11500	2 × 900	**6SL3815-2LN41-8AA1**	③
Output voltage 4.16 kV					
2000	1700	2250	280	**6SL3815-2LP32-8AA0**	①
2200	1850	2500	310	**6SL3815-2LP33-1AA0**	①
2500	2100	2750	350	**6SL3815-2LP33-5AA0**	①
2900	2400	3000	400	**6SL3815-2LP34-0AA0**	①
3200	2700	3500	450	**6SL3815-2LP34-5AA0**	①
3600	3000	4000	500	**6SL3815-2LP35-0AA0**	①
4000	3300	4500	550	**6SL3815-2LP35-5AA0**	①
4300	3600	4850	600	**6SL3815-2LP36-0AA1**	①
4800	4000	5450	660	**6SL3815-2LP36-6AA1**	①
5300	4500	6000	740	**6SL3815-2LP37-4AA0**	①
5800	4800	6500	800	**6SL3815-2LP38-0AA0**	①
6400	5300	7150	880	**6SL3815-2LP38-8AA1**	①
7200	5900	8000	1000	**6SL3815-2LP41-0AA1**	①
7900	6600	9000	2 × 550	**6SL3815-2LP41-1AA1**	③
8600	7150	9500	2 × 600	**6SL3815-2LP41-2AA1**	③
9400	7900	10000	2 × 650	**6SL3815-2LP41-3AA0**	③
10100	8500	11000	2 × 700	**6SL3815-2LP41-4AA0**	③
11500	9600	13000	2 × 800	**6SL3815-2LP41-6AA1**	③
13000	11250	15300	2 × 900	**6SL3815-2LP41-8AA1**	③

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, water cooling, with sine-wave filter	Circuit version (page 2/5)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
1500	1250	1500	380	**6SL3815-2LM35-0AA0-Z Y15**	④
1650	1350	1750	410	**6SL3815-2LM35-5AA0-Z Y15**	④
2150	1790	2400	540	**6SL3815-2LM36-0AA1-Z Y15**	④
2200	1850	2500	550	**6SL3815-2LM37-4AA0-Z Y15**	④
2350	1950	2550	590	**6SL3815-2LM36-6AA1-Z Y15**	④
2400	2000	2750	600	**6SL3815-2LM38-0AA0-Z Y15**	④
Output voltage 3.3 kV					
1550	1300	1750	270	**6SL3815-2LN33-5AA0-Z Y15**	④
1750	1450	2000	310	**6SL3815-2LN34-0AA0-Z Y15**	④
2000	1650	2250	350	**6SL3815-2LN34-5AA0-Z Y15**	④
2150	1800	2500	380	**6SL3815-2LN35-0AA0-Z Y15**	④
2350	1950	2750	410	**6SL3815-2LN35-5AA0-Z Y15**	④
3100	2550	3400	540	**6SL3815-2LN36-0AA1-Z Y15**	④
3200	2700	3500	560	**6SL3815-2LN37-4AA0-Z Y15**	④
3400	2800	3700	590	**6SL3815-2LN36-6AA1-Z Y15**	④
3500	2900	4000	610	**6SL3815-2LN38-0AA0-Z Y15**	④
5500	4550	6000	960	**6SL3815-2LN41-1AA1-Z Y15**	⑥
5600	4700	6250	980	**6SL3815-2LN41-3AA0-Z Y15**	⑥
6050	5100	6500	1060	**6SL3815-2LN41-4AA0-Z Y15**	⑥
6100	5100	7000	1080	**6SL3815-2LN41-2AA1-Z Y15**	⑥
Output voltage 4.16 kV					
1600	1300	1750	220	**6SL3815-2LP32-8AA0-Z Y15**	④
1750	1450	2000	240	**6SL3815-2LP33-1AA0-Z Y15**	④
1950	1600	2250	270	**6SL3815-2LP33-5AA0-Z Y15**	④
2250	1850	2500	310	**6SL3815-2LP34-0AA0-Z Y15**	④
2500	2100	2750	350	**6SL3815-2LP34-5AA0-Z Y15**	④
2800	2350	3000	390	**6SL3815-2LP35-0AA0-Z Y15**	④
3100	2600	3500	430	**6SL3815-2LP35-5AA0-Z Y15**	④
3900	3250	4450	540	**6SL3815-2LP36-0AA1–Z Y15**	④
4100	3450	4500	570	**6SL3815-2LP37-4AA0-Z Y15**	④
4250	3550	4750	590	**6SL3815-2LP36-6AA1–Z Y15**	④
4500	3800	5000	625	**6SL3815-2LP38-0AA0-Z Y15**	④
7150	5900	7950	960	**6SL3815-2LP41-1AA1–Z Y15**	⑥
7350	6200	8000	1020	**6SL3815-2LP41-3AA0-Z Y15**	⑥
7700	6350	8600	1080	**6SL3815-2LP41-2AA1–Z Y15**	⑥
7950	6600	9000	1100	**6SL3815-2LP41-4AA0-Z Y15**	⑥

The order code **Y15** (sine-wave filter) must be additionally specified and requires plain text
(see Description of the options, Page 6/42).

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Options

When ordering a converter with options, add **"-Z"** to the order number of the converter, followed by the order code(s) for the desired option(s).

Example:

6SL3810-2LM32-5AA0-Z
+N15+L60+...

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options		**N15**	**N20**	**N21**	**N13**
24-pulse Basic Line Module	**N15**		✓	✓	–
Capacitor tripping device 110 V to 120 V DC	**N20**	✓		–	✓
Capacitor tripping device 230 V DC	**N21**	✓	–		✓
Circuit breaker at converter input (for 24-pulse Basic Line Module on request)	**N13**	–	✓	✓	

Output-side options		**L08**	**Y15**	**L29**	**L52**	**L72**	**Y73**
Output reactor	**L08**		–	✓	✓	✓	✓
Sine-wave filter (plain text required)	**Y15**	–		✓	✓	✓	✓
Bidirectional synchronized bypass operation	**L29**	✓	✓		✓	✓	✓
Circuit breaker at converter output [1]	**L52**	✓	✓	✓		✓	✓
Braking Module	**L72**	✓	✓	✓	✓		✓
Braking resistor	**Y73**	✓	✓	✓	✓	✓	

[1] Option **L52** cannot be combined with option **L51** (disconnector at converter output).

Protective functions		**K80**	**L48**	**L49**	**L51**	**L60**	**M10**
Control of "Safe Torque Off" function (on request)	**K80**		✓	✓	✓	✓	✓
Make-proof grounding switch at converter input (motor-operated)	**L48**	✓		✓	✓	✓	✓
Make-proof grounding switch at converter output (motor-operated)	**L49**	✓	✓		✓	✓	✓
Disconnector at converter output [1]	**L51**	✓	✓	✓		✓	✓
EMERGENCY-STOP, Stop Category 1 for controlled stopping	**L60**	✓	✓	✓	✓		✓
Safety interlocking system	**M10**	✓	✓	✓	✓	✓	

[1] Option **L51** cannot be combined with option **L52** (circuit breaker at converter output).

✓ Options can be combined
– Options are mutually exclusive

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Options

Temperature sensing and evaluation (standard: 3 Pt100 inputs)		L80	L81	L82	L90	L91	L93	L95
2 thermistor motor protection relays for alarm and fault [1]	L80		–	–	✓	✓	✓	✓
2 x 2 thermistor protection relays for alarm and fault [1]	L81	–		–	✓	✓	✓	✓
3 x 2 thermistor protection relays for alarm and fault [1]	L82	–	–		✓	✓	✓	✓
Pt100 evaluation unit with 3 inputs [1]	L90	✓	✓	✓		–	–	–
2 Pt100 evaluation units with 3 inputs each [1]	L91	✓	✓	✓	–		–	–
Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control system) [1]	L93	✓	✓	✓	–	–		–
Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs [1]	L95	✓	✓	✓	–	–	–	

[1] Options **L..** cannot be combined with option **G61** (additional TM31 Terminal Module).

Increased degree of protection of the control cabinets in the air-cooled version (standard: IP22)		M11	M42
Dust protection	M11		✓
IP42 degree of protection	M42	✓	

Increased degree of protection of the control cabinets in the water-cooled version (standard: IP43)	
IP54 degree of protection	M54

Improvement in dust protection before commissioning in the water-cooled version	
Extended dust protection	M16

Controlled motor feeder for auxiliaries [1]		N30	N31	N32	N33
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 4/4.8 kW	N30		–	–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 7/8 kW	N31	–		–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 11/12.7 kW	N32	–	–		–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 15/17.5 kW	N33	–	–	–	

[1] With the ON command at the converter, the contactor is **closed**, and with the OFF command, the contactor is **opened** (example: external fan on the motor). The supply voltage for the auxiliaries must be provided externally.

Controlled outgoing feeder for auxiliaries [1]		N35	N36	N37	N38
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 1.2/1 kW	N35		–	–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 2.2/1.5 kW	N36	–		–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 3.5/2.1 kW	N37	–	–		–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 4.5/2.8 kW	N38	–	–	–	

[1] With the ON command at the converter, the contactor is **opened**, and with the OFF command, the contactor is **closed** (example: heater). The supply voltage for the auxiliaries must be provided externally.

✓ Options can be combined
– Options are mutually exclusive

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Options

Air cooling design		M61	M64
Redundant fan in the power unit	M61		–
Converter prepared for connection to an external air discharge system, with internal cabinet fans	M64	–	

Connection of power and signal cables (standard: power cable connected from below, signal cable connected directly to the terminals of the Terminal Modules)		M13	M78	M32	M33	M34	M36
Power cable connected at the converter input from the top	M13		✓	✓	✓	✓	✓
Power cable connected at the converter output from the top	M78	✓		✓	✓	✓	✓
Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm^2	M32	✓	✓		–	✓	✓
Customer's terminal strip with screw terminals for signal cables up to 2.5 mm^2	M33	✓	✓	–		✓	✓
Auxiliary voltage and signal cables connected from the top [1]	M34	✓	✓	✓	✓		✓
Cable entry, brass for power cables	M36	✓	✓	✓	✓	✓	

[1] Option **M34** can only be ordered in combination with one of the options **M32** or **M33**.

Operator control and display instruments in the door of the control cabinet		K20	K21	K22
Indicator lights in the cabinet door	K20		–	–
Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights	K21	–		–
Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights	K22	–	–	

Interface modules for connection to external bus systems (standard: PROFIBUS (slave))		G20	G21	G22	G23	G24	G25	G35
CAN bus interface (CANopen, on request)	G20		–	–	–	–	–	–
Modbus Plus interface (on request)	G21	–		–	–	–	–	–
Modbus RTU slave interface (on request)	G22	–	–		–	–	–	–
DeviceNet interface (on request)	G23	–	–	–		–	–	–
PROFINET interface (via CBE20) (on request)	G24	–	–	–	–		–	–
TeleService connection, TS Adapter II, analog modem	G25	–	–	–	–	–		–
TeleService connection, TS Adapter II, ISDN modem	G35	–	–	–	–	–	–	

✓ Options can be combined
– Options are mutually exclusive

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Options

Interface modules for additional customer connections and speed encoders		G61	G62	G63	K50
Additional TM31 Terminal Module [1]	G61		✓	✓	✓
Second additional TM31 Terminal Module [1]	G62	✓		✓	✓
Additional TM15 Terminal Module	G63	✓	✓		✓
Sensor Module Cabinet-Mounted SMC30	K50	✓	✓	✓	

[1] For the exclusions for options **G61** and **G62** see the description of the options, Page 6/16.

Other interface modules		G70	G71
Pulse distributor for transferring the speed encoder signal (on request) [1]	G70		✓
Optical bus terminal (OBT) for PROFIBUS (on request) [2]	G71	✓	

[1] Option **G70** can only be ordered in combination with option **K50** (Sensor Module Cabinet-Mounted SMC30).
[2] Option **G71** cannot be combined with options **G20 toG24** and **G34** (access to other bus systems), as well as **G25** and **G35** (Teleservice).

Additional analog inputs/outputs (isolated)		E86	E87
Additional analog inputs (isolated) [1]	E86		✓
Additional analog outputs (isolated) [1]	E87	✓	

[1] Options **E86** and **E87** cannot be combined with option **G62** (additional TM31 Terminal Module).

Industry-specific options		B00	M66
NAMUR terminal strip	B00		✓
Suitable for marine applications	M66	✓	
The following option is included as standard in option **M66:**			
Cabinet anti-condensation heating	L55	✓	✓
The following options are required for safety-relevant drives in addition to option **M66:**			
Individual certification of the converter by the relevant certification societies [1]	E11 to E71	✓	✓

[1] An inquiry is required for options **M66** and **E11 to E71** in conjunction with option **Y15** (sine-wave filter).

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Options

Individual certification of the converters for use on ships (includes option M66) [1]		E11	E21	E31	E51	E61	E71
Suitable for marine use with individual certificate from Germanische Lloyd (GL)	E11		–	–	–	–	–
Suitable for marine use with individual certificate from Lloyds Register (LR)	E21	–		–	–	–	–
Suitable for marine use with individual certificate from Bureau Veritas (BV)	E31	–	–		–	–	–
Suitable for marine use with individual certificate from Det Norske Veritas (DNV)	E51	–	–	–		–	–
Suitable for marine use with individual certificate from the American Bureau of Shipping (ABS)	E61	–	–	–	–		–
Suitable for marine use with individual certificate from the Chinese Classification Society (CCS)	E71	–	–	–	–	–	

[1] An inquiry is required for options **M66** and **E11 to E71** in conjunction with option **Y15** (sine-wave filter).

Functional options		E01	E02	E03	L32
Control for separately excited synchronous motors with slipring excitation (on request)	E01		–	–	✓
Control for separately excited synchronous motors with brushless excitation system (on request)	E02	–		–	✓
Closed-loop control of permanent-magnet synchronous motors (on request) [1]	E03	–	–		✓
Automatic restart	L32	✓	✓	✓	

[1] Option **E03** can only be ordered in combination with option **L52** (circuit breaker at the converter output).

Documentation (standard: PDF format in English on CD-ROM)		B43	B44	B45	D02	D15	Y10
Production flowchart: Generated once	B43		–	–	✓	✓	✓
Production flowchart: Updated every two weeks	B44	–		–	✓	✓	✓
Production flowchart: Updated every month	B45	–	–		✓	✓	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	D02	✓	✓	✓		✓	✓
One set of printed documentation (multiple orders possible)	D15	✓	✓	✓	✓		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	Y10	✓	✓	✓	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

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Options

Documentation in languages (standard: PDF format in English on CD-ROM)		D00	D55	D56	D57	D72	D76	D77	D78	D79	D84
Documentation in German	D00		–	–	–	–	✓	–	–	–	–
Documentation in Polish	D55	–		–	–	–	✓	–	–	–	–
Documentation in Russian	D56	–	–		–	–	✓	–	–	–	–
Documentation in Japanese (on request)	D57	–	–	–		–	✓	–	–	–	–
Documentation in Italian (on request)	D72	–	–	–	–		✓	–	–	–	–
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French	D77	–	–	–	–	–	✓		–	–	–
Documentation in Spanish	D78	–	–	–	–	–	✓	–		–	–
Documentation in Portuguese (Brazil)	D79	–	–	–	–	–	✓	–	–		–
Documentation in Chinese	D84	–	–	–	–	–	✓	–	–	–	

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91
Rating plate in English/French	T58		–	–	–	–	–	–	–
Rating plate in English/Spanish	T60	–		–	–	–	–	–	–
Rating plate in English/Italian	T80	–	–		–	–	–	–	–
Rating plate in English/Portuguese (on request)	T82	–	–	–		–	–	–	–
Rating plate in English/Russian (on request)	T85	–	–	–	–		–	–	–
Rating plate in English/Polish (on request)	T86	–	–	–	–	–		–	–
Rating plate in English/Japanese (on request)	T90	–	–	–	–	–	–		–
Rating plate in English/Chinese (on request)	T91	–	–	–	–	–	–	–	

Auxiliary voltage supply	
Auxiliary voltage other than N/400 V/3 AC	C30 to C55

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Options

Converter acceptance inspections in presence of customer		F03	F29	F73	F77	F79	F97
Visual acceptance of converter	F03		–	–	–	–	–
Noise measurement under no-load conditions	F29	–		✓	✓	✓	–
Functional acceptance of converter with inductive load	F73	–	✓		✓	✓	–
Acceptance of the converter insulation test[1]	F77	–	✓	✓		✓	–
Test of the interface between the converter and customer equipment (5 hours) [1]	F79	–	✓	✓	✓		–
Customer-specific system acceptance tests (on request)	F97	–	–	–	–	–	

[1] Options **F77** and **F79** can only be ordered in conjunction with option **F73**.

Cooling unit (water-cooled converters, standard: Cooling unit with redundant pumps and a stainless steel plate-type heat exchanger)		W02	W11	W12	W14	W20	Y40
Cooling unit with redundant stainless steel plate-type heat exchangers	W02		–	–	–	✓	–
Cooling unit with titanium plate-type heat exchanger	W11	–		–	–	✓	–
Cooling unit with redundant titanium plate-type heat exchangers	W12	–	–		–	✓	–
Converter without cooling unit (provided on the system side)	W14	–	–	–		–	–
Raw-water connection from the bottom	W20	✓	✓	✓	–		✓
Raw water data that deviates from the technical data (on request) [1]	Y40	–	–	–	–	✓	

[1] Option **Y40** includes a cooling system which is adapted to the raw water data according to the customer's specifications.

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Options

Extension of the liability for defects		Q80	Q81	Q82	Q83	Q84	Q85
Extension of the liability for defects period by 12 months to a total of 24 months	Q80		–	–	–	–	–
Extension of the liability for defects period by 18 months to a total of 30 months	Q81	–		–	–	–	–
Extension of the liability for defects period by 24 months to a total of 36 months	Q82	–	–		–	–	–
Extension of the liability for defects period by 30 months to a total of 42 months	Q83	–	–	–		–	–
Extension of the liability for defects period by 36 months to a total of 48 months	Q84	–	–	–	–		–
Extension of the liability for defects period by 48 months to a total of 60 months	Q85	–	–	–	–	–	

Miscellaneous options		L50	L53	L55	Y05	Y09
Cabinet lighting and service socket in the control section	L50		✓	✓	✓	✓
UPS for the power supply of the open-loop and closed-loop control (on request)	L53	✓		✓	✓	✓
Anti-condensation heating for the cabinet	L55	✓	✓		✓	✓
Customer-specific rating plate	Y05	✓	✓	✓		✓
Special paint finish according to RAL.... (in a color other than RAL 7035; plain text required)	Y09	✓	✓	✓	✓	

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Technical specifications

General technical data	
Power components	Diodes, 3.3 kV IGBTs
Line-side converter	
• Standard	Lower power ratings at 2.3 ... 4.16 kV: 12-pulse diode rectifier (Basic Line Module) Higher power ratings at 2.3 ... 4.16 kV: 24-pulse diode rectifier (Basic Line Module)
• Option	Lower power ratings at 2.3 ... 4.16 kV: 24-pulse diode rectifier (Basic Line Module)
Line-side converter	Inverter (Motor Module)
Closed-loop control	Closed-loop vector control
Drive quadrants	2 (driving 2 directions of rotation)
Electrical isolation, power unit/ open-loop and closed-loop control	Fiber-optic cable, insulating transformer
Auxiliary power supply (for fans, coolant pumps, precharging the DC link capacitors, open-loop and closed-loop control)	230 V 1 AC ±10 %, 50/60 Hz ±3 % and 400 V 3 AC ±10 %, 50/60 Hz ±3 % or another auxiliary voltage (options **C30 to C55**)
Installation altitude	≤ 1000 m above sea level: 100 % load capability > 1000 ... 4000 m above sea level: current derating required > 2000 ... 4000 m above sea level: voltage derating required in addition
Insulation	According to EN 50178/VDE 0160 (IEC 62103): Pollution degree 2 (without conductive pollution), condensation not permissible
Degree of protection	According to EN 60529/VDE 0470 T1 (IEC 60529):
• Standard	IP22 (air cooling), IP43 (water cooling)
• Option	IP42 (air cooling), IP54 (water cooling)
Protection class	I according to EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)
Shock-hazard protection	EN 50274/VDE 0660 T514 and BGV A3 when used for the intended application
Interference transmission	This drive unit is part of a PDS, Category C4 according to EN 61800-3/VDE 0160 T103 (IEC 61800-3). It has not been designed to be connected to the public line supply. EMC disturbances can occur when connected to these line supplies. The essential requirements placed on EMC protection for the drive system should be secured using an EMC plan on the customer side.
Paint finish/color	Indoor requirements/RAL 7035, light gray
Applicable standards and directives	
• Standards	EN 61800-3/VDE 0160 T103 (IEC 61800-3) EN 61800-4/VDE 0160 T104 (IEC 61800-4), however, only if referenced in the standards EN 61800-3 or EN 61800-5-1 EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1) EN 60146-1-1/VDE 0558 T11 (IEC 60146-1-1) EN 50178/VDE 0160 (IEC 62103) EN 60204-11/VDE 0113 T11 (IEC 60204-11), however, structuring principles and reference marking according to EN 61346-1 instead of EN 81346-1
• EU directives	2006/95/EC + amendments (Low Voltage Directive) 2004/108/EC + amendments (Electromagnetic Compatibility)
Air cooling	Forced air cooling with integrated fans
Water cooling	Water-water cooling unit, internal circuit, deionized water
Permissible coolant temperature (raw water)	
• Inlet	5 ... 35 °C
• Discharge, max.	40 °C

Rated data			
Output voltage	**2.3 kV**	**3.3 kV**	**4.16 kV**
Input voltage	2 × 1.2 kV	2 × 1.7 kV	2 × 2.2 kV
Tolerance of input voltage	±10 %	±10 %	±10 %
Line frequency	50/60 Hz ± 3 %	50/60 Hz ± 3 %	50/60 Hz ± 3 %
Line power factor fundamental mode	> 0.96	> 0.96	> 0.96

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Technical specifications

	Operation of induction motors				Operation of separately excited synchronous motors	
	Without speed encoder		With speed encoder		With speed encoder	
	Without sine-wave filter	With sine-wave filter	Without sine-wave filter	With sine-wave filter	Without sine-wave filter	With sine-wave filter
Control properties						
Operating range						
• Lower limit of speed control range (% of rated motor speed)	5 %	5 %	0 %	0 %	0 %	0 %
• Max. permissible output frequency	250 Hz	66 Hz	250 Hz	66 Hz	90 Hz	66 Hz
• Field-shunting range	1:3	1:1.1	1:3	1:1.1	1:4	1:1.1
Stationary operation						
• Speed accuracy (% of rated motor speed)	±0.2 % (from 5 % of rated speed)	±0.2 % (from 5 % of rated speed)	±0.01 %	±0.01 %	±0.01 %	±0.01 %
• Torque accuracy (% of rated torque)	±5 % (from 5 % of rated speed)	±5 % (from 5 % of rated speed)	±5 %	±5 %	±2 %	±5 %
Dynamic operation						
• Torque rise time	5 ms	20 ms	5 ms	20 ms	5 ms	20 ms

	Storage	Transport	Operation
Climatic ambient conditions			
Ambient temperature	-25 ... +70 °C	-25 ... +70 °C	5 ... 40 °C (air cooling) 5 ... 45 °C (water cooling)
Relative air humidity	5 ... 95 % (only slight condensation permitted; converter must be completely dry before commissioning)	5 ... 75 %	5 ... 85 % (condensation not permissible)
Other climatic conditions in accordance with Class	1K3 according to EN 60721-3-1 (IEC 60721-3-1) (icing not permitted)	2K2 according to EN 60721-3-2 (IEC 60721-3-2)	3K3 according to EN 60721-3-3 (IEC 60721-3-3)
Degree of pollution	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)
Mechanical ambient conditions			
Dynamic stress			
• Deflection	1.5 mm at 2 ... 9 Hz	3.5 mm at 2 ... 9 Hz	0.3 mm at 2 ... 9 Hz
• Acceleration	5 m/s^2 at 9 ... 200 Hz	10 m/s^2 at 9 ... 200 Hz 15 m/s^2 at 200 ... 500 Hz	1 m/s^2 at 9 ... 200 Hz
Other mechanical conditions in accordance with Class (increased strength for marine duty)	1M2 according to EN 60721-3-1 (IEC 60721-3-1)	2M2 according to EN 60721-3-2 (IEC 60721-3-2)	3M1 according to EN 60721-3-3 (IEC 60721-3-3)
Other ambient conditions			
Biological ambient conditions in accordance with Class	1B1 according to EN 60721-3-1 (IEC 60721-3-1)	2B1 according to EN 60721-32- (IEC 60721-3-2)	3B2 according to EN 60721-3-3 (IEC 60721-3-3) (without harmful flora)
Chemically active substances in accordance with Class	1C1 according to EN 60721-3-1 (IEC 60721-3-1)	2C1 according to EN 60721-3-2 (IEC 60721-3-2)	3C2 according to EN 60721-3-3 (IEC 60721-3-3) (no occurrence of salt mist)
Mechanically active substances in accordance with Class	1S1 according to EN 60721-3-1 (IEC 60721-3-1)	2S1 according to EN 60721-3-2 (IEC 60721-3-2)	3S1 according to EN 60721-3-3 (IEC 60721-3-3) (3S3 with water cooling and degree of protection IP54)

Note:

The values specified under storage and transport apply to suitably packed converters.

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Technical specifications

Derating for special installation conditions

Current derating

If the converters are operated at installation altitudes from 1000 m above sea level or at ambient/coolant temperatures > 40 °C for air cooling or with intake temperatures in the cooling unit > 35 °, derating factors k_H or k_T must be taken into account for the rated current (DIN 43671). For the permitted continuous current I:

$I \leq I_N \times k_H \times k_T$

I: permitted continuous current

I_N: rated current

Current derating as a function of the installation altitude (air cooling)

Derating factor k_H for air cooling

Current derating as a function of the installation altitude (water cooling)

Derating factor k_H for water cooling

Current derating as a function of ambient temperature

Derating factor k_T (ambient temperature)

Current derating as a function of the raw water intake temperature

Derating factor k_T (raw water intake temperature)

Voltage derating

For installation altitudes >2000 m, according to DIN EN 60664-1/VDE 0110 (IEC 60664-1) in addition to a current derating, a voltage derating is also required. This depends on the air and creepage distances in the unit.

Voltage derating as a function of installation altitude

Derating factor k_U

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Technical specifications

Example 1 (air-cooled converter)

Derating data SINAMICS GM150 in IGBT version

Drive unit	6SL3810-2LP33-0AA0
Output voltage	4.16 kV
Input voltage	2 × 2.2 kV
Type rating	2200 kVA, 300 A
Installation altitude	3000 m
Ambient temperature, max.	30 °C
k_H (air cooling)	0.84
k_T (ambient temperature)	1.0
k_U	0.9

For the current, the following applies:

$I \leq I_N \times 0.84 \times 1.0 = I_N \times 0.84$

A current derating of 16 % and a voltage derating of 10 % are required. The converter may still be connected to a line supply voltage of 2 x 1.98 kV 3 AC.

The maximum available output current is 252 A.

Example 2 (water-cooled converter)

Derating data SINAMICS GM150 in IGBT version

Drive unit	6SL3815-2LN33-5AA0
Output voltage	3.3 kV
Input voltage	2 × 1.7 kV
Type rating	2000 kVA, 350 A
Installation altitude	2000 m
Raw water intake temperature	40 °C
k_H (water cooling)	0.925
k_T (raw water intake temperature)	0.925
k_U	1.0

For the current, the following applies:

$I \leq I_N \times 0.925 \times 0.925 = I_N \times 0.856$

A current derating of 14.4 % is required.

The maximum available output current is 299 A.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810- 2LM32-5AA0	6SL3810- 2LM33-0AA0	6SL3810- 2LM33-5AA0	6SL3810- 2LM34-0AA0	6SL3810- 2LM34-6AA1
Output voltage 2.3 kV						
Type rating	kVA	1000	1200	1400	1600	1800
Shaft output [1]	kW	820	1000	1150	1300	1500
	hp	1000	1250	1500	1750	2000
Rated output current	A	250	300	350	400	460
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 220	2 × 264	2 × 308	2 × 351	2 × 404
Power loss [2]	kW	15	18	21	24	27
Efficiency [2]	%	98.3	98.3	98.3	98.3	98.4
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27	27
Cooling air flow rate	m^3/s	1.6	1.6	1.6	1.6	1.6
Sound pressure level L_{pA} (1 m)	dB	78	80	80	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22
Dimensions [7]						
• Width	mm	2420	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①
Weight [7]	kg	1750	1750	1750	1750	1750

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810-2LM35-3AA1	6SL3810-2LM36-0AA0	6SL3810-2LM37-0AA1	6SL3810-2LM38-0AA1
Output voltage 2.3 kV					
Type rating	kVA	2100	2400	2700	3200
Shaft output [1]	kW	1750	2000	2250	2650
	hp	2400	2750	3100	3600
Rated output current	A	530	600	700	800
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 465	2 × 539	2 × 614	2 × 702
Power loss [2]	kW	29	34	33	37
Efficiency [2]	%	98.6	98.4	98.6	98.6
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27
Cooling air flow rate	m^3/s	1.6	1.6	1.6	1.6
Sound pressure level L_{pA} (1 m)	dB	80	80	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22
Dimensions [7]					
• Width	mm	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①
Weight [7]	kg	1800	1800	1800	1800

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810-2LN31-8AA0	6SL3810-2LN32-2AA0	6SL3810-2LN32-6AA0	6SL3810-2LN33-0AA0	6SL3810-2LN33-5AA0
Output voltage 3.3 kV						
Type rating	kVA	1000	1300	1500	1700	2000
Shaft output [1]	kW	850	1050	1250	1400	1650
	hp	1000	1250	1500	2000	2250
Rated output current	A	180	220	260	300	350
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 153	2 × 199	2 × 230	2 × 260	2 × 309
Power loss [2]	kW	15	20	23	26	28
Efficiency [2]	%	98.3	98.2	98.2	98.3	98.4
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27	27
Cooling air flow rate	m^3/s	2.4	2.4	2.4	2.4	2.4
Sound pressure level L_{pA} (1 m)	dB	78	78	78	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22
Dimensions [7]						
• Width	mm	2420	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①
Weight [7]	kg	1900	1900	1900	1900	1900

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; $\cos \varphi_{typ.} = 0.6$) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810-2LN34-0AA0	6SL3810-2LN34-6AA1	6SL3810-2LN35-3AA1	6SL3810-2LN36-0AA0	6SL3810-2LN37-0AA1	6SL3810-2LN38-0AA1
Output voltage 3.3 kV							
Type rating	kVA	2300	2600	3000	3400	4000	4600
Shaft output [1]	kW	1900	2150	2500	2850	3300	3800
	hp	2500	3000	3380	3750	4500	5000
Rated output current	A	400	460	530	600	700	800
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 360	2 × 406	2 × 465	2 × 531	2 × 606	2 × 700
Power loss [2]	kW	32	34	39	44	45	52
Efficiency [2]	%	98.4	98.5	98.5	98.5	98.7	98.7
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27	27	27
Cooling air flow rate	m^3/s	2.4	2.4	2.4	2.4	2.4	2.4
Sound pressure level L_{pA} (1 m)	dB	80	80	80	80	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22	IP22
Dimensions [7]							
• Width	mm	2420	2420	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①	①
Weight [7]	kg	1950	1950	1950	2000	2000	2000

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; $\cos \varphi_{typ.} = 0.6$) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810-2LN38-8AA1	6SL3810-2LN41-1AA0	6SL3810-2LN41-2AA1	6SL3810-2LN41-4AA1
Output voltage 4.3 kV					
Type rating	kVA	5300	6300	7100	8000
Shaft output [1]	kW	4450	5300	6000	6700
	hp	6200	7000	8000	9500
Rated output current	A	2 × 465	2 × 550	2 × 625	2 × 700
Input voltage	kV	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)
Rated input current [1]	A	2 × (2 × 410)	2 × (2 × 492)	2 × (2 × 546)	2 × (2 × 611)
Power loss [2]	kW	70	82	83	96
Efficiency [2]	%	98.5	98.5	98.6	98.6
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	54	54	54	54
Cooling air flow rate	m^3/s	4.7	4.7	4.7	4.7
Sound pressure level L_{pA} (1 m)	dB	85	85	85	85
Measuring surface level L_s (1 m)	dB	18	19	18	18
Cable cross-sections, line-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22
Dimensions [7]					
• Width	mm	4220	4220	4220	4220
• Height	mm	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	③	③	③	③
Weight [7]	kg	3700	3700	3700	3700

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Without cooling system

3) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

4) Additional 20 A precharging current for 25 s.

5) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

6) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

7) The specified dimensions and weights include doors and panels, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810- 2LP31-8AA0	6SL3810- 2LP32-2AA0	6SL3810- 2LP32-6AA0	6SL3810- 2LP33-0AA0	6SL3810- 2LP33-5AA0
Output voltage 4-16 kV						
Type rating	kVA	1300	1600	1900	2200	2500
Shaft output [1]	kW	1000	1300	1550	1800	2100
	hp	1500	1750	2000	2500	3000
Rated output current	A	180	220	260	300	350
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 158	2 × 194	2 × 233	2 × 273	2 × 310
Power loss [2]	kW	20	24	27	31	33
Efficiency [2]	%	98.2	98.3	98.4	98.4	98.5
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27	27
Cooling air flow rate	m^3/s	2.4	2.4	2.4	2.4	2.4
Sound pressure level L_{pA} (1 m)	dB	78	78	78	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22
Dimensions [7]						
• Width	mm	2420	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①
Weight [7]	kg	1900	1900	1900	1950	1950

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Without cooling system

3) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

4) Additional 20 A precharging current for 25 s.

5) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

6) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

7) The specified dimensions and weights include doors and panels, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810-2LP34-0AA0	6SL3810-2LP34-6AA1	6SL3810-2LP35-3AA1	6SL3810-2LP36-0AA0	6SL3810-2LP37-0AA1	6SL3810-2LP38-0AA1
Output voltage 3-15 kV							
Type rating	kVA	2900	3300	3800	4300	5000	5800
Shaft output [1]	kW	2400	2800	3100	3600	4150	4800
	hp	3250	3800	4100	5000	5650	6600
Rated output current	A	400	460	530	600	700	800
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 359	2 × 397	2 × 465	2 × 533	2 × 600	2 × 700
Power loss [2]	kW	38	38	42	56	51	56
Efficiency [2]	%	98.5	98.7	98.7	98.5	98.8	98.8
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	27	27	27	27	27	27
Cooling air flow rate	m^3/s	2.4	2.4	2.4	2.4	2.4	2.4
Sound pressure level L_{pA} (1 m)	dB	80	80	80	80	80	80
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5) 6)]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22	IP22
Dimensions [7]							
• Width	mm	2420	2420	2420	2420	2420	2420
• Height	mm	2570	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①	①
Weight [7]	kg	1950	2000	2000	2000	2000	2000

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Without cooling system

3) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

4) Additional 20 A precharging current for 25 s.

5) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

6) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

7) The specified dimensions and weights include doors and panels, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, without sine-wave filter		6SL3810- 2LP38-8AA1	6SL3810- 2LP41-1AA0	6SL3810- 2LP41-2AA1	6SL3810- 2LP41-4AA1
Output voltage 4.16 kV					
Type rating	kVA	6700	7900	9000	10100
Shaft output [1]	kW	5650	6600	7600	8500
	hp	7600	9000	10250	11500
Rated output current	A	2 × 465	2 × 550	2 × 625	2 × 700
Input voltage	kV	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)
Rated input current [1]	A	2 × (2 × 410)	2 × (2 × 490)	2 × (2 × 543)	2 × (2 × 608)
Power loss [2]	kW	77	103	93	106
Efficiency [2]	%	98.7	98.5	98.8	98.8
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	54	54	54	54
Cooling air flow rate	m^3/s	4.7	4.7	4.7	4.7
Sound pressure level L_{pA} (1 m)	dB	85	85	85	85
Measuring surface level L_s (1 m)	dB	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22
Dimensions [7]					
• Width	mm	4220	4220	4220	4220
• Height	mm	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	③	③	③	③
Weight [7]	kg	3700	3700	3700	3700

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, with sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LM32-5AA0	6SL3810-2LM33-0AA0	6SL3810-2LM33-5AA0	6SL3810-2LM34-0AA0
Output voltage 2.3 kV					
Type rating	kVA	850	1000	1150	1300
Shaft output [1]	kW	700	800	950	1100
	hp	900	1000	1250	1500
Rated output current	A	210	250	290	330
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 182	2 × 221	2 × 257	2 × 293
Power loss [2]	kW	18	22	24	26
Efficiency [2]	%	97.5	97.5	97.5	97.5
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33	33
Cooling air flow rate	m^3/s	2.2	2.2	2.2	2.2
Sound pressure level L_{pA} (1 m)	dB	78	81	81	81
Measuring surface level L_s (1 m)	dB	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22
Dimensions [7]					
• Width	mm	3340	3340	3340	3340
• Height	mm	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④
Weight [7]	kg	2800	2800	2800	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LM34-6AA1	6SL3810-2LM35-3AA1	6SL3810-2LM36-0AA0
Output voltage 2.3 kV				
Type rating	kVA	1450	1650	2000
Shaft output [1]	kW	1200	1350	1650
	hp	1600	1850	2250
Rated output current	A	390	420	500
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 337	2 × 365	2 × 444
Power loss [2]	kW	28	31	36
Efficiency [2]	%	97.9	98.1	98.0
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33
Cooling air flow rate	m^3/s	2.2	2.2	2.2
Sound pressure level L_{pA} (1 m)	dB	81	81	81
Measuring surface level L_s (1 m)	dB	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22
Dimensions [7]				
• Width	mm	3340	3340	3340
• Height	mm	2570	2570	2570
• Depth	mm	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④
Weight [7]	kg	2900	2950	2950

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, with sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LN31-8AA0	6SL3810-2LN32-2AA0	6SL3810-2LN32-6AA0	6SL3810-2LN33-0AA0	6SL3810-2LN33-5AA0	6SL3810-2LN34-0AA0
Output voltage 3.3 kV							
Type rating	kVA	850	1100	1250	1450	1700	1950
Shaft output [1]	kW	700	900	1050	1200	1400	1600
	hp	900	1150	1250	1500	1750	2000
Rated output current	A	150	190	220	250	300	340
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 130	2 × 171	2 × 197	2 × 223	2 × 261	2 × 304
Power loss [2]	kW	19	22	24	28	31	35
Efficiency [2]	%	97.4	97.6	97.9	97.8	97.9	98.0
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33	33	33	33
Cooling air flow rate	m^3/s	3	3	3	3	3	3
Sound pressure level L_{pA} (1 m)	dB	79	79	79	81	81	81
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22	IP22
Dimensions [7]							
• Width	mm	3340	3340	3340	3340	3340	3640
• Height	mm	2570	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④	④
Weight [7]	kg	3050	3050	3100	3100	3100	3300

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LN34-6AA1	6SL3810-2LN35-3AA1	6SL3810-2LN36-0AA0	6SL3810-2LN38-8AA1	6SL3810-2LN41-1AA0
Output voltage 3.3 kV						
Type rating	kVA	2350	2600	2900	4750	5350
Shaft output [1]	kW	1850	2100	2450	3650	4500
	hp	2500	2850	3250	5100	6000
Rated output current	A	410	440	510	830	940
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × (2 × 1.7)	2 × (2 × 1.7)
Rated input current [1]	A	2 × 347	2 × 417	2 × 453	2 × (2 × 355)	2 × (2 × 420)
Power loss [2]	kW	40	42	49	73	86
Efficiency [2]	%	98.1	98.1	98.1	98.2	98.2
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33	66	66
Cooling air flow rate	m^3/s	3	3	3	5.8	5.8
Sound pressure level L_{pA} (1 m)	dB	81	81	81	87	87
Measuring surface level L_s (1 m)	dB	18	18	18	19	19
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22
Dimensions [7]						
• Width	mm	3640	3640	3640	6660	6660
• Height	mm	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	⑥	⑥
Weight [7]	kg	3350	3350	3500	6500	6500

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

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[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Air cooling, with sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LP31-8AA0	6SL3810-2LP32-2AA0	6SL3810-2LP32-6AA0	6SL3810-2LP33-0AA0	6SL3810-2LP33-5AA0	6SL3810-2LP34-0AA0
Output voltage 4.16 kV							
Type rating	kVA	1100	1350	1600	1850	2100	2450
Shaft output [1]	kW	900	1150	1300	1550	1750	2000
	hp	1250	1500	1750	2000	2250	2750
Rated output current	A	150	190	220	260	290	340
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 133	2 × 163	2 × 195	2 × 225	2 × 262	2 × 304
Power loss [2]	kW	24	25	29	33	38	41
Efficiency [2]	%	97.5	97.9	97.9	98.0	98.0	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33	33	33	33
Cooling air flow rate	m^3/s	3	3	3	3	3	3
Sound pressure level L_{pA} (1 m)	dB	79	79	79	81	81	81
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22	IP22
Dimensions [7]							
• Width	mm	3640	3640	3640	3640	3640	3640
• Height	mm	2570	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④	④
Weight [7]	kg	3300	3300	3300	3350	3350	3350

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Air cooling, with sine-wave filter (option Y15)		6SL3810-2LP34-6AA1	6SL3810-2LP35-3AA1	6SL3810-2LP36-0AA0	6SL3810-2LP38-8AA1	6SL3810-2LP41-1AA0
Output voltage 4.16 kV						
Type rating	kVA	2950	3250	3600	6000	6650
Shaft output [1]	kW	2400	2600	3000	5100	5500
	hp	3250	3600	4000	6800	7500
Rated output current	A	410	480	500	830	920
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × (2 × 2.2)	2 × (2 × 2.2)
Rated input current [1]	A	2 × 355	2 × 417	2 × 449	2 × (2 × 355)	2 × (2 × 413)
Power loss [2]	kW	43	48	61	85	106
Efficiency [2]	%	98.2	98.2	98.1	98.3	98.2
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	2.5	2.5	2.5	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	33	33	33	66	66
Cooling air flow rate	m^3/s	3	3	3	5.8	5.8
Sound pressure level L_{pA} (1 m)	dB	81	81	81	87	87
Measuring surface level L_s (1 m)	dB	18	18	18	19	19
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22	IP22
Dimensions [7]						
• Width	mm	3640	3640	3640	6660	6660
• Height	mm	2570	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	⑥	⑥
Weight [7]	kg	3450	3450	3450	6500	6600

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system

[3] The typical current drawn (rms value; cos φ_{typ} = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors, panels and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, without sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LM35-0AA0	6SL3815-2LM35-5AA0	6SL3815-2LM36-0AA1	6SL3815-2LM36-6AA1
Output voltage 2.3 kV					
Type rating	kVA	2000	2200	2400	2600
Shaft output [1]	kW	1650	1800	2000	2150
	hp	2250	2500	2750	2950
Rated output current	A	500	550	600	660
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 444	2 × 494	2 × 519	2 × 575
Power loss [2] [3]	kW	28	31	33	34
Efficiency [3]	%	98.4	98.4	98.4	98.4
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	25	25	25	25
Raw water flow rate	l/min	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①
Weight [8]	kg	2600	2650	2650	2650

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LM37-4AA0	6SL3815-2LM38-0AA0	6SL3815-2LM38-8AA1	6SL3815-2LM41-0AA1
Output voltage 2.3 kV					
Type rating	kVA	2900	3200	3500	4000
Shaft output [1]	kW	2450	2650	2900	3300
	hp	3250	3500	3850	4400
Rated output current	A	740	800	880	1000
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 650	2 × 717	2 × 771	2 × 870
Power loss [2] [3]	kW	38	42	42	44
Efficiency [3]	%	98.5	98.5	98.6	98.7
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	25	25	25	25
Raw water flow rate	l/min	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①
Weight [8]	kg	2700	2700	2700	2700

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LN33-5AA0	6SL3815-2LN34-0AA0	6SL3815-2LN34-5AA0	6SL3815-2LN35-0AA0	6SL3815-2LN35-5AA0
Output voltage 3.3 kV						
Type rating	kVA	2000	2300	2600	2900	3100
Shaft output [1]	kW	1650	1900	2150	2400	2650
	hp	2250	2500	3000	3250	3500
Rated output current	A	350	400	450	500	550
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 309	2 × 360	2 × 406	2 × 453	2 × 484
Power loss [2] [3]	kW	28	32	34	38	40
Efficiency [3]	%	98.4	98.4	98.5	98.5	98.6
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	14	14	14	14	14
Raw water flow rate	l/min	183	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43
Dimensions [8]						
• Width	mm	3620	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①
Weight [8]	kg	2750	2800	2800	2800	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LN36-0AA1	6SL3815-2LN36-6AA1	6SL3815-2LN37-4AA0	6SL3815-2LN38-0AA0	6SL3815-2LN38-8AA1	6SL3815-2LN41-0AA1
Output voltage 3 ~ 3 kV							
Type rating	kVA	3400	3800	4200	4600	5100	5700
Shaft output [1]	kW	2800	3150	3500	3800	4250	4700
	hp	3800	4200	4500	5000	6000	6150
Rated output current	A	600	660	740	800	880	1000
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 521	2 × 575	2 × 656	2 × 719	2 × 756	2 × 870
Power loss [2] [3]	kW	42	46	55	60	56	63
Efficiency [3]	%	98.5	98.6	98.5	98.5	98.7	98.7
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	25	25	25	25	25	25
Raw water flow rate	l/min	183	183	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	3620	3620	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①	①
Weight [8]	kg	2850	2850	2850	2850	2850	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, without sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LN41-1AA1	6SL3815-2LN41-2AA1	6SL3815-2LN41-3AA0	6SL3815-2LN41-4AA0	6SL3815-2LN41-6AA1	6SL3815-2LN41-8AA1
Output voltage 3.3 kV							
Type rating	kVA	6300	6800	7400	8000	9100	10300
Shaft output [1]	kW	5300	5600	6200	6700	7600	8600
	hp	7000	7400	8000	9000	10200	11500
Rated output current	A	2 × 550	2 × 600	2 × 650	2 × 700	2 × 800	2 × 900
Input voltage	kV	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)
Rated input current [1]	A	2 × (2 × 492)	2 × (2 × 519)	2 × (2 × 578)	2 × (2 × 625)	2 × (2 × 671)	2 × (2 × 784)
Power loss [2] [3]	kW	80	87	96	104	104	117
Efficiency [3]	%	98.5	98.5	98.5	98.5	98.7	98.7
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	4	4	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31	31
Raw water flow rate	l/min	283	283	283	283	283	283
Deionized water requirement, approx.	l	100	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	76	76	76	76	76	76
Measuring surface level L_s (1 m)	dB	19	19	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	5420	5420	5420	5420	5420	5420
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	③	③	③	③	③	③
Weight [8]	kg	4200	4200	4200	4200	4200	4200

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Approx. 5 % of the power loss is dissipated in the room.

3) Without cooling system

4) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

5) Additional 20 A precharging current for 25 s.

6) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

7) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

8) The specified dimensions and weights include doors, panels and cooling unit, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LP32-8AA0	6SL3815-2LP33-1AA0	6SL3815-2LP33-5AA0	6SL3815-2LP34-0AA0	6SL3815-2LP34-5AA0	6SL3815-2LP35-0AA0
Output voltage 4.16 kV							
Type rating	kVA	2000	2200	2500	2900	3200	3600
Shaft output [1]	kW	1700	1850	2100	2400	2700	3000
	hp	2250	2500	2750	3000	3500	4000
Rated output current	A	280	310	350	400	450	500
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 245	2 × 273	2 × 310	2 × 359	2 × 397	2 × 446
Power loss [2] [3]	kW	28	31	33	38	42	47
Efficiency [3]	%	98.4	98.4	98.5	98.5	98.5	98.5
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	25	25	25	25	25	25
Raw water flow rate	l/min	183	183	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	3620	3620	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①	①
Weight [8]	kg	2750	2800	2800	2800	2850	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, without sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LP35-5AA0	6SL3815-2LP36-0AA1	6SL3815-2LP36-6AA1	6SL3815-2LP37-4AA0	6SL3815-2LP38-0AA0	6SL3815-2LP38-8AA1	6SL3815-2LP41-0AA1
Output voltage 4.16 kV								
Type rating	kVA	4000	4300	4800	5300	5800	6400	7200
Shaft output [1]	kW	3300	3600	4000	4500	4800	5300	5900
	hp	4500	4850	5450	6000	6500	7150	8000
Rated output current	A	550	600	660	740	800	880	1000
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 496	2 × 519	2 × 575	2 × 657	2 × 719	2 × 772	2 × 870
Power loss [2] [3]	kW	52	46	51	69	75	65	74
Efficiency [3]	%	98.5	98.7	98.7	98.5	98.6	98.8	98.8
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	25	25	25	25	25	25	25
Raw water flow rate	l/min	183	183	183	183	183	183	183
Deionized water requirement, approx.	l	90	90	90	90	90	90	90
Sound pressure level L_{pA} (1 m)	dB	73	73	73	73	73	73	73
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]								
• Width	mm	3620	3620	3620	3620	3620	3620	3620
• Height	mm	2280	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	①	①	①	①	①	①	①
Weight [8]	kg	2850	2850	2850	2850	2850	2850	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, without sine-wave filter		6SL3815-2LP41-1AA1	6SL3815-2LP41-2AA1	6SL3815-2LP41-3AA0	6SL3815-2LP41-4AA0	6SL3815-2LP41-6AA1	6SL3815-2LP41-8AA1
Output voltage 4.16 kV							
Type rating	kVA	7900	8600	9400	10100	11500	13000
Shaft output [1]	kW	6600	7150	7900	8500	9600	11250
	hp	9000	9500	10000	11000	13000	15300
Rated output current	A	2 × 550	2 × 600	2 × 650	2 × 700	2 × 800	2 × 900
Input voltage	kV	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)
Rated input current [1]	A	2 × (2 × 490)	2 × (2 × 519)	2 × (2 × 583)	2 × (2 × 627)	2 × (2 × 694)	2 × (2 × 785)
Power loss [2] [3]	kW	86	94	122	131	118	133
Efficiency [3]	%	98.7	98.7	98.5	98.5	98.8	98.8
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	4	4	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31	31
Raw water flow rate	l/min	283	283	283	283	283	283
Deionized water requirement, approx.	l	100	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	76	76	76	76	76	76
Measuring surface level L_s (1 m)	dB	19	19	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	5420	5420	5420	5420	5420	5420
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/4)	Fig. No.	③	③	③	③	③	③
Weight [8]	kg	4200	4200	4200	4200	4200	4200

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, with sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LM35-0AA0	6SL3815-2LM35-5AA0	6SL3815-2LM36-0AA1	6SL3815-2LM37-4AA0	6SL3815-2LM36-6AA1	6SL3815-2LM38-0AA0
Output voltage 2.3 kV							
Type rating	kVA	1500	1650	2150	2200	2350	2400
Shaft output [1]	kW	1250	1350	1790	1850	1950	2000
	hp	1500	1750	2400	2500	2550	2750
Rated output current	A	380	410	540	550	590	600
Input voltage	kV	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2	2 × 1.2
Rated input current [1]	A	2 × 331	2 × 364	2 × 467	2 × 491	2 × 513	2 × 540
Power loss [2] [3]	kW	29	30	31	39	34	41
Efficiency [3]	%	97.8	97.9	98.0	98.0	98.0	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31	31
Raw water flow rate	l/min	183	183	183	183	183	183
Deionized water requirement, approx.	l	100	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	74	74	74	74	74	74
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	4540	4540	4540	4540	4540	4540
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④	④
Weight [8]	kg	3750	3850	3900	3950	3950	3950

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Approx. 5 % of the power loss is dissipated in the room.

3) Without cooling system

4) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

5) Additional 20 A precharging current for 25 s.

6) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

7) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

8) The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LN33-5AA0	6SL3815-2LN34-0AA0	6SL3815-2LN34-5AA0	6SL3815-2LN35-0AA0	6SL3815-2LN35-5AA0
Output voltage 3.3 kV						
Type rating	kVA	1550	1750	2000	2150	2350
Shaft output [1]	kW	1300	1450	1650	1800	1950
	hp	1750	2000	2250	2500	2750
Rated output current	A	270	310	350	380	410
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 234	2 × 269	2 × 307	2 × 346	2 × 370
Power loss [2] [3]	kW	29	32	36	40	42
Efficiency [3]	%	97.8	97.9	98.0	98.0	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31
Raw water flow rate	l/min	183	183	183	183	183
Deionized water requirement, approx.	l	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	74	74	74	74	74
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43
Dimensions [8]						
• Width	mm	4540	4840	4840	4840	4840
• Height	mm	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④
Weight [8]	kg	4000	4200	4200	4200	4300

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version; Water cooling, with sine-wave filter

2

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LN36-0AA1	6SL3815-2LN37-4AA0	6SL3815-2LN36-6AA1	6SL3815-2LN38-0AA0
Output voltage 3.3 kV					
Type rating	kVA	3100	3200	3400	3500
Shaft output [1]	kW	2550	2700	2800	2900
	hp	3400	3500	3700	4000
Rated output current	A	540	560	590	610
Input voltage	kV	2 × 1.7	2 × 1.7	2 × 1.7	2 × 1.7
Rated input current [1]	A	2 × 467	2 × 501	2 × 513	2 × 549
Power loss [2] [3]	kW	44	54	49	60
Efficiency [3]	%	98.2	98.1	98.2	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31
Raw water flow rate	l/min	183	183	183	183
Deionized water requirement, approx.	l	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	74	74	74	74
Measuring surface level L_s (1 m)	dB	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	4840	4840	4840	4840
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④
Weight [8]	kg	4400	4400	4400	4400

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LN41-1AA1	6SL3815-2LN41-3AA0	6SL3815-2LN41-4AA0	6SL3815-2LN41-2AA1
Output voltage 3.3 kV					
Type rating	kVA	5500	5600	6050	6100
Shaft output [1]	kW	4550	4700	5100	5100
	hp	6000	6250	6500	7000
Rated output current	A	960	980	1060	1080
Input voltage	kV	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)	2 × (2 × 1.7)
Rated input current [1]	A	2 × (2 × 429)	2 × (2 × 441)	2 × (2 × 477)	2 × (2 × 479)
Power loss [2] [3]	kW	78	90	97	82
Efficiency [3]	%	98.3	98.2	98.2	98.3
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	43	43	43	43
Raw water flow rate	l/min	283	283	283	283
Deionized water requirement, approx.	l	120	120	120	120
Sound pressure level L_{pA} (1 m)	dB	78	78	78	78
Measuring surface level L_s (1 m)	dB	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	7860	7860	7860	7860
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	⑥	⑥	⑥	⑥
Weight [8]	kg	7100	7100	7300	7300

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

2) Approx. 5 % of the power loss is dissipated in the room.

3) Without cooling system

4) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

5) Additional 20 A precharging current for 25 s.

6) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

7) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

8) The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version
Water cooling, with sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LP32-8AA0	6SL3815-2LP33-1AA0	6SL3815-2LP33-5AA0	6SL3815-2LP34-0AA0	6SL3815-2LP34-5AA0
Output voltage 4 kV						
Type rating	kVA	1600	1750	1950	2250	2500
Shaft output [1]	kW	1300	1450	1600	1850	2100
	hp	1750	2000	2250	2500	2750
Rated output current	A	220	240	270	310	350
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 190	2 × 210	2 × 240	2 × 282	2 × 311
Power loss [2] [3]	kW	30	31	35	41	43
Efficiency [3]	%	97.8	97.9	98.0	98.0	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31
Raw water flow rate	l/min	183	183	183	183	183
Deionized water requirement, approx.	l	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	74	74	74	74	74
Measuring surface level L_s (1 m)	dB	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43
Dimensions [8]						
• Width	mm	4840	4840	4840	4840	4840
• Height	mm	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④
Weight [8]	kg	4200	4250	4250	4250	4300

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LP35-0AA0	6SL3815-2LP35-5AA0	6SL3815-2LP36-0AA1	6SL3815-2LP37-4AA0	6SL3815-2LP36-6AA1	6SL3815-2LP38-0AA0
Output voltage 4.16 kV							
Type rating	kVA	2800	3100	3900	4100	4250	4500
Shaft output [1]	kW	2350	2600	3250	3450	3550	3800
	hp	3000	3500	4450	4500	4750	5000
Rated output current	A	390	430	540	570	590	625
Input voltage	kV	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2	2 × 2.2
Rated input current [1]	A	2 × 350	2 × 388	2 × 471	2 × 514	2 × 513	2 × 562
Power loss [2] [3]	kW	48	53	57	66	59	72
Efficiency [3]	%	98.1	98.1	98.2	98.2	98.3	98.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	2.5	2.5	2.5	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	31	31	31	31	31	31
Raw water flow rate	l/min	183	183	183	183	183	183
Deionized water requirement, approx.	l	100	100	100	100	100	100
Sound pressure level L_{pA} (1 m)	dB	74	74	74	74	74	74
Measuring surface level L_s (1 m)	dB	18	18	18	18	18	18
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43	IP43
Dimensions [8]							
• Width	mm	4840	4840	4840	4840	4840	5440 [9]
• Height	mm	2280	2280	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	④	④	④	④	④	④
Weight [8]	kg	4300	4300	4850	4850	4850	5200

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

[9] For a combination with the power cable connection at the converter output from the top (option **M78**), then the cabinet width decreases by 600 mm.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGBT version: Water cooling, with sine-wave filter

Technical specifications

SINAMICS GM150 in IGBT version Water cooling, with sine-wave filter (option Y15)		6SL3815-2LP41-1AA1	6SL3815-2LP41-3AA0	6SL3815-2LP41-2AA1	6SL3815-2LP41-4AA0
Output voltage 4.16 kV					
Type rating	kVA	7150	7350	7700	7950
Shaft output [1]	kW	5900	6200	6350	6600
	hp	7950	8000	8600	9000
Rated output current	A	960	1020	1080	1100
Input voltage	kV	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)	2 × (2 × 2.2)
Rated input current [1]	A	2 × (2 × 431)	2 × (2 × 456)	2 × (2 × 464)	2 × (2 × 491)
Power loss [2] [3]	kW	95	117	103	126
Efficiency [3]	%	98.3	98.2	98.3	98.2
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	43	43	43	43
Raw water flow rate	l/min	283	283	283	283
Deionized water requirement, approx.	l	120	120	120	120
Sound pressure level L_{pA} (1 m)	dB	78	78	78	78
Measuring surface level L_s (1 m)	dB	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	7860	7860	7860	7860
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 2/5)	Fig. No.	⑥	⑥	⑥	⑥
Weight [8]	kg	7200	8200	8200	8200

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0.6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 2/5.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels, cooling unit and sine-wave filter (option **Y15**), however no additional options.

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SINAMICS GM150 in IGCT version

3

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Type-related technical data

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGCT version

Overview

SINAMICS GM150 as IGCT version

The water-cooled SINAMICS GM150 converters in the IGCT version with IGCT Motor Modules represent an expansion of the SINAMICS GM150 converters in the IGBT version in the upper power range up to 21 MVA.

SINAMICS GM150 converters as IGCT version are optimally matched to Siemens motors.

SINAMICS GM150 converters as IGCT version offer economic drive solutions that can be matched to customers' specific requirements by adding from the wide range of available components and options.

IGCT converters are available for the following voltage and outputs:

Rated output voltage	Type rating
3.3 kV	10 MVA to 21 MVA

Global use

SINAMICS GM150 converters as IGCT version are manufactured to international standards and regulations, making them ideally suited for global use. These converters are also available in ship-going form (meeting the requirements of all major classification organizations).

Benefits

- Compact design and high flexibility in configuration ensures easy plant integration
- Easy operation and monitoring on the convenient operator panel
- Easy and reliable operation through integrated maintenance functions: the converter signals early and automatically if maintenance is required or components need to be exchanged
- High robustness and reliability due to the use of IGCT power semiconductors in the high power range and fuseless installation combined with intelligent reaction to external disturbances
- Can be easily integrated into automation solutions due to PROFIBUS interface supplied as standard and various analog and digital interfaces
- High level of service-friendliness through innovative power section design with compact phase modules and easy access to all components

Design

SINAMICS GM150 converters in the IGCT version are available in the basic connection with a 12-pulse or 24-pulse Basic Line Module (option).

For greater output ratings, two or three complete converter units with isolated DC links are operated in parallel.

Phase components in which IGCTs, diodes etc. are grouped together in one pressure stack are used in the Motor Modules.

The converter consists of cabinet units for the Basic Line Module and for the Motor Module. One of three phase modules and the control section in the Motor Module cabinet unit are highlighted in the illustration.

SINAMICS GM150 as IGCT version, internal design (without cooling unit)

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Design

Block diagram

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Design

The following wiring versions are available for SINAMICS GM150 as IGCT version.

Basic circuit
12-pulse infeed

24-pulse infeed through series connection of two Basic Line Modules: option **N15**

Two converter units operated in parallel in order to increase the output [1], 24-pulse infeed

Three converter units operated in parallel in order to increase the output [1], 36-pulse infeed

[1] Requires a motor with separate winding systems.

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Function

Characteristic features

SINAMICS GM150 as IGCT version		
Line Module (rectifier on mains side)		
Basic Line Module, 12-pulse (two-quadrant operation)	Standard	
Basic Line Module, 24-pulse (two-quadrant operation)	Option Standard for parallel connection	
Basic Line Module, 36-pulse (two-quadrant operation)	Standard for triple parallel connection	
Motor Module (rectifier on motor side)		
Voltage range	3.3 kV	
Power range (typ.)	10 ... 21 MVA	
Cooling method		
• Water cooling	Standard	
Control modes		
• Induction motor	Standard	Standard
• Synchronous motor, separately excited	Option	Option
• Synchronous motor, separately excited, with brushless (RG) excitation system	On request	On request
• Synchronous motor, permanently excited	On request	Option

Software and protection functions

SINAMICS GM150 in the IGCT version	Description
Closed-loop control	The motor-side closed-loop control is realized as a field-oriented closed-loop vector control that can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamic performance of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely independently of each other. Prescribed torques can thus be observed and limited accurately. In the speed range from 1:10, the field-oriented closed-loop control does not require an actual speed value encoder. An actual speed value encoder is required in the following scenarios: • High dynamics requirements • Torque control/constant torque drives with a control range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal strip. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all of the interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with variable smoothing times in the lower and upper speed ranges, improves the control response and therefore prevents mechanical overloading of the drive train. The ramp-down ramps can be parameterized separately for emergency stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Power supply failures are bridged to the extent permitted by the kinetic energy of the drive train. The speed drops depending on the moment of inertia and the load torque. The current speed setpoint is resumed when the power supply returns. This function can cause fast load cycles changes which may have a negative effect on the infeed line (in particular on weak lines e.g. on ships).
Automatic restart (option L32)	The automatic restart switches the drive on again when the power is restored after a power failure or a general fault, and ramps up to the current speed setpoint.
Flying restart	The flying restart function permits smooth connection of the converter to a rotating motor.
Diagnostics functions	• Self-diagnosis of control hardware • Non-volatile memory for reliable diagnosis when the power supply fails • Monitoring the IGBTs with individual messages for each mounting location • User-friendly on-site operator panel with plain text messages
Operating hours and switching cycle counter	The switching cycles of the circuit breakers are detected and summed to form the basis for preventive maintenance work.

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SINAMICS GM150
Medium-Voltage Converter

SINAMICS GM150 in IGCT version

Function

SINAMICS GM150 in the IGCT version	Description
Detecting the actual motor speed (option)	The SMC30 encoder module can be used to record the actual motor speed. The signals from the rotary pulse encoder are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.
Operator protection	The cabinet doors of the power units are fitted with electromagnetic locks. This prevents the cabinet doors being opened while hazardous voltages are connected inside the cabinet.
EMERGENCY-OFF button	The converters are equipped as standard with an EMERGENCY-OFF button with protective collar which is fitted in the cabinet door. The contacts of the button are connected in parallel to the terminal strip so they can be integrated in a protection concept on the plant side. EMERGENCY-OFF stop category 0 is set as standard for an uncontrolled shutdown (EN 60204-1/VDE 0113-1 (IEC 60204-1)). The function includes voltage disconnection of the converter output through the circuit breaker. The motor coasts in the process. EMERGENCY-STOP category 1 is optionally available for a controlled shutdown (option **L60**).
Insulation monitoring	The converters feature insulation monitoring of the complete electrical circuit from the secondary side of the transformer to the stator windings of the motor.
Monitoring of the peripherals	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available. In addition, it is possible to monitor the temperature with thermocouples or Pt100 resistors.
Thermal overload protection	An alarm message is issued first when the overtemperature threshold is reached. If the temperature rises further, either a shutdown is carried out or automatic influencing of the output current so that a reduction in the thermal load is achieved. Following elimination of the cause of the fault (e.g. improvement in the ventilation), the original operating values are automatically resumed. In the case of water-cooled converters, the water temperature and flow rate are recorded at several points in the cooling circuit and evaluated. An extensive self-diagnosis protects the converter and reports faults.
Grounding switch (option)	If grounding on the infeed or motor side is required for safety and protection reasons, a motorized grounding switch can be ordered. For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.

AOP30 operator panel

The AOP30 operator panel is fitted into the cabinet door of the SINAMICS GM150 to enable operation, monitoring and commissioning.

It has the following features and characteristics:

- Graphical LCD display with backlighting for plain-text display and a bar display of process variables
- LEDs for displaying the operational status
- Help function describing causes of and remedies for faults and alarms
- Membrane keyboard with keypad for operational control of a drive
- Local/remote switchover to select the operator control location (priority assigned to operator panel or customer's terminal strip/PROFIBUS)
- Numeric keypad for input of setpoint or parameter values
- Function keys for prompted navigation in the menu
- Two-stage safety strategy to protect against accidental or unauthorized changes to settings. The keyboard lock disables operation of the drive from the operator panel, so that only parameter values and process variables can be displayed. A password can be used to prevent the unauthorized modification of converter parameters.

The operator panel languages – English, German, Spanish and Chinese – are stored on the CompactFlash card of the Control Unit.

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Configuration

Standard dimensioning

If the motor data are not precisely known, then the converter should be dimensioned based on the rated output current for typical induction motors. If current derating is required, then the derating factors are applied to this rated output current. The current derating when converter units are operated in parallel has already been taken into account for the values in the selection and ordering data table.

Higher output currents are also possible under certain conditions; refer to the following section.

Detailed dimensioning

If the motor data are more precisely known, then the converters can also be operated with higher output currents. In this case, the rated motor current must lie below the maximum thermal converter output current, and the motor short-circuit current must be less than the maximum permissible motor short-circuit current of the converter.

Note:

The motor short-circuit current is the current that flows in a system in the first 100 ms if all subsystems are short-circuited and the leakage paths are saturated.

For higher rated output currents, the type-specific technical data can differ. Please contact your regional Siemens sales partner if you have any questions on this topic.

During the detailed dimensioning phase, derating factors should be applied to the maximum thermal converter output current. The current derating when converter units are operated in parallel has already been taken into account for the values in the selection and ordering data table.

Selection and ordering data

Type rating	Shaft output		Rated output current for typical induction motors	Max. thermal output current	Max. motor short-circuit current for induction motors	**SINAMICS GM150 in the IGCT version**	Circuit version (Page 3/4)
kVA	kW	hp	A	A	A	Order No.	Fig. No.
Output voltage 3.3 kV							
10000	8000	11000	1750	1750	8700	**6SL3835-2LN41-8AA0**	⑦
15500	13000	17000	2 × 1360	2 × 1440	7200	**6SL3835-2LN42-8AA0**	⑨
18000	15000	20000	2 × 1570	2 × 1660	8300	**6SL3835-2LN43-6AA0**	⑨
21000	17000	23000	3 × 1220	3 × 1630	8100	**6SL3835-2LN44-2AA0**	⑩

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Options

When ordering a converter with options, add **"-Z"** to the order number of the converter, followed by the order code(s) for the desired option(s).

Example:

6SL3835-2LN41-8AA0-Z
+N15+L60+...

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options		N15	N13
24-pulse Basic Line Module [1]	N15		–
Circuit breaker at converter input (for 24-pulse Basic Line Module on request)	N13	–	

[1] Option **N15** cannot be combined with option **L72** (Braking Module).

Output-side options		L08	L52	L72	Y73
Output reactor	L08		✓	✓	✓
Circuit breaker at converter output [1]	L52	✓		✓	✓
Braking Module [2]	L72	✓	✓		✓
Braking resistor	Y73	✓	✓	✓	

[1] Option **L52** cannot be combined with option **L51** (disconnector at converter output).
[2] Option **L72** cannot be combined with option **N15** (24-pulse Basic Line Module).

Protective functions		K80	L48	L49	L51	L60	M10
Control of "Safe Torque Off" function (on request)	K80		✓	✓	✓	✓	✓
Make-proof grounding switch at converter input (motor-operated)	L48	✓		✓	✓	✓	✓
Make-proof grounding switch at converter output (motor-operated)	L49	✓	✓		✓	✓	✓
Disconnector at converter output [1]	L51	✓	✓	✓		✓	✓
EMERGENCY-STOP, Stop Category 1 for controlled stopping	L60	✓	✓	✓	✓		✓
Safety interlocking system	M10	✓	✓	✓	✓	✓	

[1] Option **L51** cannot be combined with option **L52** (circuit breaker at converter output).

✓ Options can be combined
– Options are mutually exclusive

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Options

Temperature sensing and evaluation (standard: 3 Pt100 inputs)		L80	L81	L82	L90	L91	L92	L93	L94	L95	L96
2 thermistor motor protection relays for alarm and fault [1]	L80		–	–	✓	✓	✓	✓	✓	✓	✓
2 x 2 thermistor protection relays for alarm and fault[1]	L81	–		–	✓	✓	✓	✓	✓	✓	✓
3 x 2 thermistor protection relays for alarm and fault[1]	L82	–	–		✓	✓	✓	✓	✓	✓	✓
Pt100 evaluation unit with 3 inputs[1]	L90	✓	✓	✓				–	–	–	–
2 Pt100 evaluation units with 3 inputs each[1]	L91	✓	✓	✓	–		–	–	–	–	–
3 Pt100 evaluation units with 3 inputs each[1]	L92	✓	✓	✓	–	–		–	–	–	–
Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control system)[1]	L93	✓	✓	✓	–	–	–		–	–	–
2 Pt100 evaluation units each with 6 inputs and 2 analog outputs (outputs for display connected to the control system)[2]	L94	✓	✓	✓	–	–	–	–		–	–
Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system)[1]	L95	✓	✓	✓	–	–	–	–	–		–
2 Pt100 evaluation units each with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system)[2]	L96	✓	✓	✓	–	–	–	–	–	–	

[1] Options **L..** cannot be combined with option **G61** (additional TM31 Terminal Module).

[2] Option **L94** and **L96** cannot be combined with options **G61** and **G62** (additional Terminal Modules TM31) as well as with option **E86** (additional analog inputs).

Increased degree of protection of the control cabinets in the water-cooled version (standard: IP43)	
IP54 degree of protection	M54

Controlled motor feeder for auxiliaries [1]		N30	N31	N32	N33
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 4/4.8 kW	N30		–	–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 7/8 kW	N31	–		–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 11/12.7 kW	N32	–	–		–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 15/17.5 kW	N33	–	–	–	

[1] With the ON command at the converter, the contactor is **closed**, and with the OFF command, the contactor is **opened** (example: external fan on the motor). The supply voltage for the auxiliaries must be provided externally.

Controlled outgoing feeder for auxiliaries [1]		N35	N36	N37	N38
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 1.2/1 kW	N35		–	–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 2.2/1.5 kW	N36	–		–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 3.5/2.1 kW	N37	–	–		–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 4.5/2.8 kW	N38	–	–	–	

[1] With the ON command at the converter, the contactor is **opened**, and with the OFF command, the contactor is **closed** (example: heater). The supply voltage for the auxiliaries must be provided externally.

✓ Options can be combined

– Options are mutually exclusive

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Options

Connection of signal cables (standard: signal cable connected directly to the terminals of the Terminal Modules)		M32	M33	M36
Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm²	M32		–	✓
Customer's terminal strip with screw terminals for signal cables up to 2.5 mm²	M33	–		✓
Cable entry, brass for power cables	M36	✓	✓	

Operator control and display instruments in the door of the control cabinet		K20	K21	K22
Indicator lights in the cabinet door	K20		–	–
Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights	K21	–		–
Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights	K22	–	–	

Interface modules for connection to external bus systems (standard: PROFIBUS (slave))		G20	G21	G22	G23	G24
CAN bus interface (CANopen, on request)	G20		–	–	–	–
Modbus Plus interface (on request)	G21	–		–	–	–
Modbus RTU slave interface (on request)	G22	–	–		–	–
DeviceNet interface (on request)	G23	–	–	–		–
PROFINET interface (via CBE20) (on request)	G24	–	–	–	–	

Interface modules for additional customer connections and speed encoders		G61	G62	G63	K50
Additional TM31 Terminal Module [1]	G61		✓	✓	✓
Second additional TM31 Terminal Module [1]	G62	✓		✓	✓
Additional TM15 Terminal Module	G63	✓	✓		✓
Sensor Module Cabinet-Mounted SMC30	K50	✓	✓	✓	

[1] For the exclusions for options **G61** and **G62** see the description of the options, Page 6/16.

Additional analog inputs/outputs (isolated)		E86	E87
Additional analog inputs (isolated) [1]	E86		✓
Additional analog outputs (isolated) [2]	E87	✓	

[1] Option **E86** cannot be combined with option **G62** (second additional TM31 Terminal Module) as well as with options **L94** and **L96** (2 Pt100 evaluation units).
[2] Option **E87** cannot be combined with option **G62** (second additional TM31 Terminal Module).

✓ Options can be combined
– Options are mutually exclusive

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Options

Other interface modules		G66	G70	G71
PADU8 diagnostic module (8 analog and 8 digital signals)	G66		✓	✓
Pulse distributor for transferring the speed encoder signal (on request) [1]	G70	✓		✓
Optical bus terminal (OBT) for PROFIBUS (on request) [2]	G71	✓	✓	

[1] Option **G70** can only be ordered in combination with option **K50** (Sensor Module Cabinet-Mounted SMC30).
[2] Option **G71** cannot be combined with options **G20 to G24** and **G34** (access to other bus systems).

Industry-specific options		B00	M66
NAMUR terminal strip	B00		✓
Suitable for marine applications	M66	✓	
The following option is included as standard in option **M66** :			
Cabinet anti-condensation heating	L55	✓	✓
The following options are required for safety-relevant drives in addition **to option M66** :			
Individual certification of the converter by the relevant certification societies	E11 to E71	✓	✓

Individual certification of the converters for use on ships (includes option M66)		E11	E21	E31	E51	E61	E71
Suitable for marine use with individual certificate from Germanische Lloyd (GL)	E11		–	–	–	–	–
Suitable for marine use with individual certificate from Lloyds Register (LR)	E21	–		–	–	–	–
Suitable for marine use with individual certificate from Bureau Veritas (BV)	E31	–	–		–	–	–
Suitable for marine use with individual certificate from Det Norske Veritas (DNV)	E51	–	–	–		–	–
Suitable for marine use with individual certificate from the American Bureau of Shipping (ABS)	E61	–	–	–	–		–
Suitable for marine use with individual certificate from the Chinese Classification Society (CCS)	E71	–	–	–	–	–	

Functional options		E01	E02	E03	L32
Control for separately excited synchronous motors with slipring excitation (on request)	E01		–	–	✓
Control for separately excited synchronous motors with brushless excitation system (on request)	E02	–		–	✓
Control for permanently-excited synchronous motors [1] (on request) [1]	E03	–	–		✓
Automatic restart	L32	✓	✓	✓	

[1] Option **E03** can only be ordered in combination with option **L52** (circuit breaker at the converter output).

✓ Options can be combined
– Options are mutually exclusive

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Options

Documentation (standard: PDF format in English on CD-ROM)		B43	B44	B45	D02	D15	Y10
Production flowchart: Generated once	B43		–	–	✓	✓	✓
Production flowchart: Updated every two weeks	B44	–		–	✓	✓	✓
Production flowchart: Updated every month	B45	–	–		✓	✓	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	D02	✓	✓	✓		✓	✓
One set of printed documentation (multiple orders possible)	D15	✓	✓	✓	✓		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	Y10	✓	✓	✓	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

Documentation in languages (standard: PDF format in English on CD-ROM)		D00	D55	D56	D57	D72	D76	D77	D78	D79	D84
Documentation in German	D00		–	–	–	–	✓	–	–	–	–
Documentation in Polish	D55	–		–	–	–	✓	–	–	–	–
Documentation in Russian	D56	–	–		–	–	✓	–	–	–	–
Documentation in Japanese (on request)	D57	–	–	–		–	✓	–	–	–	–
Documentation in Italian (on request)	D72	–	–	–	–		✓	–	–	–	–
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French	D77	–	–	–	–	–	✓		–	–	–
Documentation in Spanish	D78	–	–	–	–	–	✓	–		–	–
Documentation in Portuguese (Brazil)	D79	–	–	–	–	–	✓	–	–		–
Documentation in Chinese	D84	–	–	–	–	–	✓	–	–	–	

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91
Rating plate in English/French	T58		–	–	–	–	–	–	–
Rating plate in English/Spanish	T60	–		–	–	–	–	–	–
Rating plate in English/Italian	T80	–	–		–	–	–	–	–
Rating plate in English/Portuguese (on request)	T82	–	–	–		–	–	–	–
Rating plate in English/Russian (on request)	T85	–	–	–	–		–	–	–
Rating plate in English/Polish (on request)	T86	–	–	–	–	–		–	–
Rating plate in English/Japanese (on request)	T90	–	–	–	–	–	–		–
Rating plate in English/Chinese (on request)	T91	–	–	–	–	–	–	–	

Auxiliary voltage supply	
Auxiliary voltage other than N/400 V/3 AC	C30 to C55

✓ Options can be combined
– Options are mutually exclusive

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Options

Converter acceptance inspections in presence of customer		F03	F73	F77	F79	F97
Visual acceptance of converter	F03		–	–	–	–
Functional acceptance of converter with inductive load	F73	–		✓	✓	–
Acceptance of the converter insulation test [1]	F77	–	✓		✓	–
Test of the interface between the converter and customer equipment (5 hours) [1]	F79	–	✓	✓		–
Customer-specific system acceptance tests (on request)	F97	–	–	–	–	

[1] Options **F77** and **F79** can only be ordered in conjunction with option **F73** .

Cooling unit (standard: Cooling unit with redundant pumps and a stainless steel plate-type heat exchanger)		W02	W11	W12	W14	Y40
Cooling unit with redundant stainless steel plate-type heat exchangers	W02		–	–	–	–
Cooling unit with titanium plate-type heat exchanger	W11	–		–	–	–
Cooling unit with redundant titanium plate-type heat exchangers	W12	–	–		–	–
Converter without cooling unit (provided on the system side)	W14	–	–	–		–
Raw water data that deviates from the technical data (on request) [1]	Y40	–	–	–	–	

[1] Option **Y40** includes a cooling system which is adapted to the raw water data according to the customer's specifications.

Extension of the liability for defects		Q80	Q81	Q82	Q83	Q84	Q85
Extension of the liability for defects period by 12 months to a total of 24 months	Q80		–	–	–	–	–
Extension of the liability for defects period by 18 months to a total of 30 months	Q81	–		–	–	–	–
Extension of the liability for defects period by 24 months to a total of 36 months	Q82	–	–		–	–	–
Extension of the liability for defects period by 30 months to a total of 42 months	Q83	–	–	–		–	–
Extension of the liability for defects period by 36 months to a total of 48 months	Q84	–	–	–	–		–
Extension of the liability for defects period by 48 months to a total of 60 months	Q85	–	–	–	–	–	

Miscellaneous options		L50	L53	L55	Y05	Y09
Cabinet lighting and service socket in the control section	L50		✓	✓	✓	✓
UPS for the power supply of the open-loop and closed-loop control (on request)	L53	✓		✓	✓	✓
Anti-condensation heating for the cabinet	L55	✓	✓		✓	✓
Customer-specific rating plate	Y05	✓	✓	✓		✓
Special paint finish acc. to RAL.... (in a color other than RAL 7035; plain text required)	Y09	✓	✓	✓	✓	

✓ Options can be combined
– Options are mutually exclusive

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Technical specifications

General technical data	
Power components	Diodes, IGCTs
Line-side converter	
• Standard	12-pulse diode rectifier (Basic Line Module)
• Option	24-pulse diode rectifier (Basic Line Module)
Motor-side converter	Inverter (Motor Module)
Closed-loop control	Closed-loop vector control
Drive quadrants	2 (2 directions of rotation, driving)
Electrical isolation, power unit/ open-loop and closed-loop control	Closed-loop vector control, insulating transformer
Auxiliary power supply (for fans, coolant pumps, precharging the DC link capacitors, open-loop and closed-loop control)	230 V 1 AC ±10 %, 50/60 Hz ±3 % and 400 V 3 AC ±10 %, 50/60 Hz ±3 % or another auxiliary voltage (options **C30 to C55**)
Installation altitude	≤ 1000 m above sea level: 100 % load capability >1000 ... 4000 m above sea level: current derating required >2000 ... 4000 m above sea level: voltage derating required in addition
Insulation	According to EN 50178/VDE 0160 (IEC 62103): Pollution degree 2 (without conductive pollution), condensation not permissible
Degree of protection	According to EN 60529/VDE 0470 T1 (IEC 60529): IP43
Protection class	I acc. to EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)
Shock-hazard protection	EN 50274/VDE 0660 T514 and BGV A3 when used for the intended application
Interference transmission	This drive unit is part of a PDS, Category C4 acc. to EN 61800-3/VDE 0160 T103 (IEC 61800-3). It has not been designed to be connected to the public line supply. EMC disturbances can occur when connected to these line supplies. The essential requirements placed on EMC protection for the drive system should be secured using an EMC plan on the customer side.
Paint finish/color	Indoor requirements/RAL 7035, light gray
Applicable standards and directives	
• Standards	EN 61800-3/VDE 0160 T103 (IEC 61800-3) EN 61800-4/VDE 0160 T104 (IEC 61800-4), however, only if referenced in the standards EN 61800-3 or EN 61800-5-1 EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1) EN 60146-1-1/VDE 0558 T11 (IEC 60146-1-1) EN 50178/VDE 0160 (IEC 62103) EN 60204-11/VDE 0113 T11 (IEC 60204-11), however, structuring principles and reference marking according to EN 61346-1 instead of EN 81346-1
• EU directives	2006/95/EC + amendments (Low Voltage Directive) 2004/108/EC + amendments (Electromagnetic Compatibility)
Water cooling	Water-water cooling unit, internal circuit, deionized water
Permissible coolant temperature (raw water)	
• Inlet	5 ... 35 °C
• Discharge, max.	40 °C

Rated data	
Output voltage	**3.3 kV**
Input voltage	2 × 1.7 kV
Tolerance of input voltage	±10 %
Line frequency	50/60 Hz ± 3 %
Line power factor fundamental mode	> 0.96

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Technical specifications

	Operation of induction motors		Operation of separately excited synchronous motors
	Without speed encoder	With speed encoder	With speed encoder
Control properties			
Operating range			
• Lower limit of speed control range (% of rated motor speed)	5 %	0 %	0 %
• Max. permissible output frequency	250 Hz	250 Hz	90 Hz
• Field-shunting range	1:3	1:3	1:4
Stationary operation			
• Speed accuracy (% of rated motor speed)	± 0.2 % (from 5 % of rated speed)	± 0.01 %	± 0.01 %
• Torque accuracy (% of rated torque)	± 5 % (from 5 % of rated speed)	± 5 %	± 2 %
Dynamic operation			
• Torque rise time	5 ms	5 ms	5 ms

	Storage	Transport	Operation
Climatic ambient conditions			
Ambient temperature	-25 ... +70 °C	-25 ... +70 °C	5 ... 45 °C
Relative air humidity	5 ... 95 % (only slight condensation permitted; converter must be completely dry before commissioning)	5 ... 75 %	5 ... 85 % (condensation not permissible)
Other climatic conditions in accordance with Class	1K3 acc. to EN 6072131 (IEC 6072131) (formation of ice not permissible)	2K2 acc. to EN 6072132 (IEC 6072132)	3K3 acc. to EN 6072133 (IEC 6072133)
Degree of pollution	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)
Mechanical ambient conditions			
Dynamic stress			
• Deflection	1.5 mm at 2 ... 9 Hz	3.5 mm at 2 ... 9 Hz	0.3 mm at 2 ... 9 Hz
• Acceleration	5 m/s^2 at 9 ... 200 Hz	10 m/s^2 at 9 ... 200 Hz 15 m/s^2 at 200 ... 500 Hz	1 m/s^2 at 9 ... 200 Hz
Other mechanical conditions in accordance with Class (increased strength for marine duty)	1M2 acc. to EN 6072131 (IEC 60721-3-1)	2M2 acc. to EN 6072132 (IEC 60721-3-2)	3M1 acc. to EN 6072133 (IEC 60721-3-3)
Other ambient conditions			
Biological ambient conditions in accordance with Class	1B1 acc. to EN 6072131 (IEC 6072131)	2B1 acc. to EN 6072132 (IEC 6072132)	3B2 acc. to EN 6072133 (IEC 6072133) (without damaging flora)
Chemically active substances in accordance with Class	1C1 acc. to EN 6072131 (IEC 6072131)	2C1 acc. to EN 6072132 (IEC 6072132)	3C2 acc. to EN 6072133 (IEC 6072133) (no salt mist)
Mechanically active substances in accordance with Class	1S1 acc. to EN 6072131 (IEC 6072131)	2S1 acc. to EN 6072132 (IEC 6072132)	3S1 acc. to EN 6072133 (IEC 6072133)

Note:

The values specified under storage and transport apply to suitably packed converters.

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Technical specifications

Derating for special installation conditions

Current derating

If the converters are operated at installation altitudes above 1000 m above sea level or with intake temperatures in the cooling unit > 35 °, derating factors k_H or k_T must be taken into account for the rated current (DIN 43671). For the permitted continuous current I:

$I \leq I_N \times k_H \times k_T$

I permitted continuous current

I_N rated current

Current derating as a function of the installation altitude (water cooling)

Derating factor k_H for water cooling

Current derating as a function of the raw water intake temperature

Derating factor k_T (raw water intake temperature)

Voltage derating

For installation altitudes > 2000 m, acc. to EN 60664-1/VDE 0110 (IEC 60664-1) in addition to a current derating, a voltage derating is also required. This depends on the air and creepage distances in the unit.

Voltage derating as a function of installation altitude

Derating factor k_U

Example

Derating data SINAMICS GM150 in IGCT version

Drive unit	6SL3835-2LN43-6AA0
Output voltage	3.3 kV
Input voltage	2 × (2 × 1.7) kV
Type rating	18000 kVA, 2 × 1570 A
Installation altitude	2000 m
Raw water intake temperature	40 °C
k_H (water cooling)	0.925
k_T (raw water intake temperature)	0.925
k_U	1.0

For the current, the following applies:

$I \times I_N \times 0.925 \times 0.925 = I_N \times 0.856$

For the standard version, a current derating of 14.4 % is required.

The maximum available output current is 1344 A for each subsystem.

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Technical specifications

SINAMICS GM150 as IGCT version Water cooling		6SL3835-2LN41-8AA0	6SL3835-2LN42-8AA0	6SL3835-2LN43-6AA0	6SL3835-2LN44-2AA0
Output voltage 3.3 kV					
Type rating	kVA	10000	15500	18000	21000
Shaft output [1]	kW	8000	13000	15000	17000
	hp	11000	17000	20000	23000
Rated output current	A	1750	2 × 1360	2 × 1570	3 × 1220
Max. thermal output current	A	1750	2 × 1440	2 × 1660	3 × 1630
Max. motor short-circuit current	A	8700	7200	8300	8100
Input voltage	kV	2 × 1.7	2 × (2 × 1.7)	2 × (2 × 1.7)	3 × (2 × 1.7)
Rated input current [1]	A	2 × 1550	2 × (2 × 1240)	2 × (2 × 1450)	3 × (2 × 1150)
Power loss [2] [3]	kW	80	128	160	192
Efficiency [3]	%	99.1	99.1	99.1	99.1
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	3	6	6	9
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	17	20	20	23
Precharging current demand, briefly for approx. 25 s	A	20	40	40	60
Raw water flow rate	l/min	208	417	417	667
Deionized water requirement, approx.	l	135	170	170	255
Sound pressure level L_{pA} (1 m)	dB	75	77	77	79
Measuring surface level L_s (1 m)	dB	22	23	23	24
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	3 × 120	6 × 120	6 × 120	9 × 120
	AWG/MCM (NEC, CEC)	3 × 250 MCM	6 × 250 MCM	6 × 250 MCM	9 × 250 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [7]					
• Width	mm	5300	9400	9400	14300
• Height	mm	2540	2540	2540	2540
• Depth	mm	1600	1600	1600	1600
Circuit version (Page 3/4)	Fig. No.	⑦	⑨	⑨	⑩
Weight [7]	kg	5400	9800	9800	15000

Footnotes see next page.

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Technical specifications

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with induction motors and for a typical motor power factor cos φ and motor efficiency. The calculation is based on the rated output current. In this case, the kW and hp values lie in a power range, which is obtained by selecting the following values: Motor power factor between 0.85 and 0.88 and a motor efficiency of 96 %. The rated input current also depends on the line power factor, for which a typical value of between 0.94 and 0.96 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 500. Both approximate values need to be adapted to the motor which is actually used.

2) Approx. 5 % of the power loss is dissipated in the room.

3) Without cooling system

4) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0,6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

5) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Page 3/4.

6) The maximum permissible cable lengths must be carefully observed (see Power cables, Page 9/13).

7) The specified dimensions and weights include doors, panels and cooling unit, however no options.

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SINAMICS SM150 in IGBT version

4

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Type-related technical data

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SINAMICS SM150
Medium-Voltage Converter

SINAMICS SM150 in IGBT version

Overview

SINAMICS SM150 in the IGBT version

SINAMICS SM150 converters in the IGBT version, capable of energy recovery, are available as single-motor drives with IGBT power semiconductors.

IGBT converters are available for the following voltages and power ranges.

Rated output voltage	Type rating with air cooling	Type rating with water cooling
3.3 kV	3.4 and 4.6 MVA	4.6 and 5.7 MVA
4.16 kV	4.3 and 5.8 MVA	5.8 and 7.2 MVA

The rated power in the specific application will depend on the necessary load cycle.

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies) please contact your Siemens partner in sales with the required specifications.

Global use

SINAMICS SM150 converters in the IGBT version are manufactured to international standards and regulations, making them ideally suited for global use.

Benefits

- Compact design and highly flexible configuration ensures easy plant integration
- Simple operator control and monitoring from the user-friendly operator panel
- Simple and reliable operation through integrated maintenance functions: The converter signals early on and automatically if maintenance is required or components need to be replaced
- High degree of ruggedness and reliability by using HV-IGBT technology and a fuseless design combined with intelligent response to external disturbances
- Can be easily integrated into automation solutions as the PROFIBUS interface is supplied as standard along with various analog and digital interfaces
- High level of service-friendliness through innovative power unit design with plug-in Powercards and easy access to all components
- By appropriately engineering the drive system, reactive power can be made available to other drives, therefore helping ensure that the plant or system is cost effective.

Design

Active Line Modules and Motor Modules have an almost identical design. HV-IGBT power semiconductors are used in both – they are mounted on plug-in power cards that are simple to replace.

In the basic circuit, one Active Line Module and one Motor Module are interconnected via a DC link.

The converter consists of cabinet units for the Active Line Module and for the Motor Module. In the following diagram, one Powercard and the Control Unit are marked in the Motor Module.

SINAMICS SM150 in the IGBT version, water cooling, internal design without cooling unit

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Design

Block diagram

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Design

The following circuit is available for SINAMICS SM150 in the IGBT version.

Basic circuit

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Function

Characteristic features

SINAMICS SM150 in the IGBT version	
Line Module (rectifier on mains side)	
Active Line Module (four-quadrant operation)	Standard
Motor Module (rectifier on motor side)	
Voltage range	3.3 kV/4.16 kV
Power range, typ.	3.4 ... 7.2 MVA
Cooling method	
• Air cooling	Standard
• Water cooling	Standard
Control modes	Standard: With encoder
• Induction motor	Standard
• Synchronous motor, separately excited	Option
• Synchronous motor, separately excited, with brushless excitation system	On request
• Synchronous motor, permanently excited	On request

Software and protection functions

SINAMICS SM150 in the IGBT version	Description
Closed-loop control	The motor-side closed-loop control is realized as a field-oriented closed-loop vector control that can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamic performance of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely independently of each other. Prescribed torques can thus be observed and limited accurately. In the speed range from 1:10, the field-oriented closed-loop control does not require an actual speed value encoder. An actual speed value encoder is required in the following scenarios: • High dynamics requirements • Torque control/constant torque drives with a control range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal strip. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all of the interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with variable smoothing times in the lower and upper speed ranges, improves the control response and therefore prevents mechanical overloading of the drive train. The ramp-down ramps can be parameterized separately for emergency stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Power supply failures are bridged to the extent permitted by the kinetic energy of the drive train. The speed drops depending on the moment of inertia and the load torque. The current speed setpoint is resumed when the power supply returns.
Automatic restart	The automatic restart switches the drive on again when the power is restored after a power failure or a general fault, and ramps up to the current speed setpoint.
Flying restart	The flying restart function permits smooth connection of the converter to a rotating motor.
Diagnostics functions	• Self-diagnosis of control hardware • Non-volatile memory for reliable diagnosis when the power supply fails • Monitoring of HV-IGBTs with individual messages for each mounting location • User-friendly on-site operator panel with plain text messages
Operating hours and switching cycle counter	The operating hours of the non-redundant fans, which are located on the roof section of the cabinets, are detected and logged so that preventive maintenance can be performed or equipment replaced as a preventive measure. The switching cycles of the circuit breaker are recorded and added together, to form the basis of preventive maintenance work.

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SINAMICS SM150
Medium-Voltage Converter

SINAMICS SM150 in IGBT version

Function

SINAMICS SM150 in the IGBT version	Description
Detecting the motor actual speed	The SMC30 encoder module can be used to record the actual motor speed. The signals from the rotary pulse encoder are converted here and made available for evaluation to the closed-loop controller via the DRIVE-CLiQ interface.
Operator protection	The cabinet doors of the power units are fitted with electromagnetic locks. This prevents the cabinet doors being opened while hazardous voltages are connected inside the cabinet.
EMERGENCY-OFF button	The converters are equipped as standard with an EMERGENCY-OFF button with protective collar which is fitted in the cabinet door. The contacts of the button are connected in parallel to the terminal strip so they can be integrated in a protection concept on the plant side. EMERGENCY-OFF stop category 0 is set as standard for an uncontrolled shutdown (EN 60204-1/VDE 0113-1 (IEC 60204-1)). The function includes voltage disconnection of the converter output through the circuit breaker. The motor coasts in the process. The control of the "Safe Torque Off" function is optionally available (option **K80**).
Insulation monitoring	The converters feature insulation monitoring of the complete electrical circuit from the secondary side of the transformer to the stator windings of the motor.
Monitoring of the peripherals	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available. In addition it is possible to monitor the temperature with thermocouples or Pt100 resistors.
Thermal overload protection	An alarm message is issued first when the overtemperature threshold is reached. If the temperature rises further, either a shutdown is carried out or automatic influencing of the output current so that a reduction in the thermal load is achieved. Following elimination of the cause of the fault (e.g. improvement in the ventilation), the original operating values are automatically resumed. For instance, for air-cooled converters and when filter mats are used, the amount of pollution of the filter mats is monitored by measuring the differential pressure which is then signaled. In the case of water-cooled converters, the water temperature and flow rate are recorded at several points in the cooling circuit and evaluated. An extensive self-diagnosis protects the converter and reports faults.
Grounding switch (option)	If grounding on the infeed or motor side is required for safety and protection reasons, a motorized grounding switch can be ordered. For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.

SIMATIC OP 177B operator panel

The SIMATIC OP 177B operator panel is fitted into the cabinet door of the SINAMICS SM150 to enable operation, monitoring and commissioning.

It has the following features and characteristics:

- 5.7" STN touch display
- Context-dependent operations by touch, permanently available functions can be selected using individual keys
- Non-volatile message buffer, no battery

English and German are available as operator panel languages.

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Selection and ordering data

Air cooling

Type rating	Shaft output		Rated output current	**SINAMICS SM150 in the IGBT version, air-cooled**	Circuit version (Page 4/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 3.3 kV					
3400	2800	3600	600	**6SL3810-7NN36-0AA0**	⑪
4600	3800	4950	800	**6SL3810-7NN38-0AA1**	⑪
Output voltage 4.16 kV					
4300	3600	4700	600	**6SL3810-7NP36-0AA0**	⑪
5800	4800	6500	800	**6SL3810-7NP38-0AA1**	⑪

Water cooling

Type rating	Shaft output		Rated output current	**SINAMICS GM150 in the IGBT version, water-cooled**	Circuit version (Page 4/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 3.3 kV					
4600	3800	4950	800	**6SL3815-7NN38-0AA0**	⑪
5700	4700	6350	1000	**6SL3815-7NN41-0AA1**	⑪
Output voltage 4.16 kV					
5800	4800	6500	800	**6SL3815-7NP38-0AA0**	⑪
7200	5900	8000	1000	**6SL3815-7NP41-0AA1**	⑪

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies) please contact your Siemens partner in sales indicating the required specifications.

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Options

When ordering a converter with options, add **"-Z"** to the order number of the converter, followed by the order code(s) for the desired option(s).

Example:

6SL3810-7NN36-0AA0-Z
+G63+L08+...

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Output-side options		**L08**	**L52**	**L72**	**Y73**
Output reactor	**L08**		✓	✓	✓
Circuit breaker at converter output [1]	**L52**	✓		✓	✓
Braking Module (on request)	**L72**	✓	✓		✓
Braking resistor (on request)	**Y73**	✓	✓	✓	

[1] Option **L52** cannot be combined with option **L51** (disconnector at converter output).

Protective functions		**K80**	**L48**	**L49**	**L51**	**M10**
Control of "Safe Torque Off" function	**K80**		✓	✓	✓	✓
Make-proof grounding switch at converter input (motor-operated, on request)	**L48**	✓		✓	✓	✓
Make-proof grounding switch at converter output (motor-operated, on request)	**L49**	✓	✓		✓	✓
Disconnector at converter output [1]	**L51**	✓	✓	✓		✓
Safety interlocking system	**M10**	✓	✓	✓	✓	

[1] Option **L51** cannot be combined with option **L52** (circuit breaker at converter output).

✓ Options can be combined
– Options are mutually exclusive

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Options

Temperature sensing and evaluation (standard: 3 Pt100 inputs)		L80	L81	L82	L90	L91	L92	L93	L94	L95	L96
2 thermistor motor protection relays for alarm and fault [1]	L80		–	–	✓	✓	✓	✓	✓	✓	✓
2 x 2 thermistor protection relays for alarm and fault [1]	L81	–		–	✓	✓	✓	✓	✓	✓	✓
3 x 2 thermistor protection relays for alarm and fault [1]	L82	–	–		✓	✓	✓	✓	✓	✓	✓
Pt100 evaluation unit with 3 inputs [1]	L90	✓	✓	✓		–	–	–	–	–	–
2 Pt100 evaluation units with 3 inputs each [1]	L91	✓	✓	✓	–		–	–	–	–	–
3 Pt100 evaluation units with 3 inputs each [1]	L92	✓	✓	✓	–	–		–	–	–	–
Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control system) [1]	L93	✓	✓	✓	–	–	–		–	–	–
2 Pt100 evaluation units each with 6 inputs and 2 analog outputs (outputs for display connected to the control system) [2]	L94	✓	✓	✓	–	–	–	–		–	–
Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system) [1]	L95	✓	✓	✓	–	–	–	–	–		–
2 Pt100 evaluation units each with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system) [2]	L96	✓	✓	✓	–	–	–	–	–	–	

[1] Options **L..** cannot be combined with option **G61** (additional TM31 Terminal Module).

[2] Option **L94** and **L96** cannot be combined with options **G61** and **G62** (additional Terminal Modules TM31) as well as with option **E86** (additional analog inputs).

Controlled motor feeder for auxiliaries [1]		N30	N31	N32	N33
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 4/4.8 kW	N30		–	–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 7/8 kW	N31	–		–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 11/12.7 kW	N32	–	–		–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 15/17.5 kW	N33	–	–	–	

[1] With the ON command at the converter, the contactor is **closed**, and with the OFF command, the contactor is **opened** (example: external fan on the motor). The supply voltage for the auxiliaries must be provided externally.

Controlled outgoing feeder for auxiliaries [1]		N35	N36	N37	N38
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 1.2/1 kW	N35		–	–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 2.2/1.5 kW	N36	–		–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 3.5/2.1 kW	N37	–	–		–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 4.5/2.8 kW	N38	–	–	–	

[1] With the ON command at the converter, the contactor is **opened**, and with the OFF command, the contactor is **closed** (example: heater). The supply voltage for the auxiliaries must be provided externally.

✓ Options can be combined

– Options are mutually exclusive

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Options

Connection of signal cables (standard: signal cable connected directly to the terminals of the Terminal Modules)		M32	M33
Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm²	M32		–
Customer's terminal strip with screw terminals for signal cables up to 2.5 mm²	M33	–	

Operator control and display instruments in the door of the control cabinet		K20	K21	K22
Indicator lights and Start/Stop button in the cabinet door	K20		–	–
Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights and start/stop buttons	K21	–		–
Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights and start/stop buttons	K22	–	–	

Interface modules for additional customer connections		G61	G62	G63
Additional TM31 Terminal Module [1]	G61		✓	✓
Second additional TM31 Terminal Module [1]	G62	✓		✓
Additional TM15 Terminal Module	G63	✓	✓	

[1] For the exclusions for options **G61** and **G62** see the description of the options, Page 6/16.

Additional analog inputs/outputs (isolated)		E86	E87
Additional analog inputs (isolated) [1]	E86		✓
Additional analog outputs (isolated) [2]	E87	✓	

[1] Option **E86** cannot be combined with option **G62** (second additional TM31 Terminal Module) as well as with options **L94** and **L96** (2 Pt100 evaluation units).
[2] Option **E87** cannot be combined with option **G62** (second additional TM31 Terminal Module).

Other interface modules		G66	G70	G71
PADU8 diagnostic module (8 analog and 8 digital signals)	G66		✓	✓
Pulse distributor to transfer the speed encoder signal	G70	✓		✓
Optical bus terminal (OBT) for PROFIBUS	G71	✓	✓	

Industry-specific options	
NAMUR terminal strip	B00

✓ Options can be combined
– Options are mutually exclusive

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Options

Functional options		E00	E01	E02	E03
Control for separately-excited synchronous motors (static excitation unit is provided on the plant side)	E00		–	–	–
Control for separately excited synchronous motors with slipring excitation	E01	–		–	–
Control for separately excited synchronous motors with brushless excitation system (on request)	E02	–	–		–
Closed-loop control of permanent-magnet synchronous motors (on request) [1]	E03		–	–	

[1] Option **E03** can only be ordered in combination with option **L52** (circuit breaker at the converter output).

Documentation (standard: PDF format in English on CD-ROM)		D02	D15	Y10
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	D02		✓	✓
One set of printed documentation (multiple orders possible)	D15	✓		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	Y10	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

Documentation in languages (standard: PDF format in English on CD-ROM)		D00	D55	D56	D57	D72	D76	D77	D78	D79	D84
Documentation in German	D00		–	–	–	–	✓	–	–	–	–
Documentation in Polish	D55	–		–	–	–	✓	–	–	–	–
Documentation in Russian	D56	–	–		–	–	✓	–	–	–	–
Documentation in Japanese (on request)	D57	–	–	–		–	✓	–	–	–	–
Documentation in Italian (on request)	D72	–	–	–	–		✓	–	–	–	–
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French	D77	–	–	–	–	–	✓		–	–	–
Documentation in Spanish	D78	–	–	–	–	–	✓	–		–	–
Documentation in Portuguese (Brazil)	D79	–	–	–	–	–	✓	–	–		–
Documentation in Chinese	D84	–	–	–	–	–	✓	–	–	–	

Auxiliary voltage supply	
Auxiliary voltage other than N/400 V/3 AC	C30 to C55

✓ Options can be combined
– Options are mutually exclusive

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Options

Converter acceptance inspections in presence of customer		F03	F29	F73	F77	F79	F97
Visual acceptance of converter	F03		–	–	–	–	–
Noise measurement under no-load conditions	F29	–		✓	✓	✓	–
Functional acceptance of converter with inductive load	F73	–	✓		✓	✓	–
Acceptance of the converter insulation test[1)]	F77	–	✓	✓		✓	
Test of the interface between the converter and customer equipment (5 hours, on request) [1)]	F79	–	✓	✓	✓		–
Customer-specific system acceptance tests (on request)	F97	–	–	–	–	–	

[1)] Options **F77** and **F79** can only be ordered in conjunction with option **F73** .

Cooling unit (water-cooled converters, standard: Cooling unit with redundant pumps and a		W02	W11	W12	W14
Cooling unit with redundant stainless steel plate-type heat exchangers	W02		–	–	–
Cooling unit with titanium plate-type heat exchanger	W11	–		–	–
Cooling unit with redundant titanium plate-type heat exchangers	W12	–	–		–
Converter without cooling unit (provided on the system side)	W14	–	–	–	

Miscellaneous options		L50	L55	Y05	Y09
Cabinet lighting and service socket in the control section	L50		✓	✓	✓
Anti-condensation heating for the cabinet	L55	✓		✓	✓
Customer-specific rating plate	Y05	✓	✓		✓
Special paint finish acc. to RAL.... (in a color other than RAL 7035; plain text required)	Y09	✓	✓	✓	

✓ Options can be combined

– Options are mutually exclusive

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Technical specifications

General technical data	
Power components	3.3 kV IGBTs
Line-side converter	Regulated, self-commutating infeed/regenerative unit (Active Line Module)
Motor-side converter	Inverter (Motor Module)
Closed-loop control	Closed-loop vector control
Drive quadrants	4 (driving and braking per 2 directions of rotation)
Electrical isolation, power unit/ open-loop and closed-loop control	Fiber-optic cable, insulating transformer
Auxiliary power supply (for fans, coolant pumps, precharging the DC link capacitors, open-loop and closed-loop control)	230 V 1 AC ±10 %, 50/60 Hz ±3 % and 400 V 3 AC ±10 %, 50/60 Hz ±3 % or another auxiliary voltage (options **C30 to C55**)
Installation altitude	≤ 1000 m above sea level: 100 % load capability >1000 ... 4000 m above sea level: current derating required > 2000 ... 4000 m above sea level: voltage derating required in addition
Insulation	According to EN 50178/VDE 0160 (IEC 62103): Pollution degree 2 (without conductive pollution), condensation not permissible
Degree of protection	According to EN 60529/VDE 0470 T1 (IEC 60529): IP22 (air cooling), IP43 (water cooling)
Protection class	I acc. to EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)
Shock-hazard protection	EN 50274/VDE 0660 T514 and BGV A3 when used for the intended application
Interference transmission	This drive unit is part of a PDS, Category C4 acc. to EN 61800-3/VDE 0160 T103 (IEC 61800-3). It has not been designed to be connected to the public line supply. EMC disturbances can occur when connected to these line supplies. The essential requirements placed on EMC protection for the drive system should be secured using an EMC plan on the customer side.
Paint finish/color	Indoor requirements/RAL 7035, light gray
Applicable standards and directives	
• Standards	EN 61800-3/VDE 0160 T103 (IEC 61800-3) EN 61800-4/VDE 0160 T104 (IEC 61800-4), however, only if referenced in the standards EN 61800-3 or EN 61800-5-1 EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1) EN 60146-1-1/VDE 0558 T11 (IEC 60146-1-1) EN 50178/VDE 0160 (IEC 62103) EN 60204-11/VDE 0113 T11 (IEC 60204-11), however, structuring principles and reference marking according to EN 61346-1 instead of EN 81346-1
• EU directives	2006/95/EC + amendments (Low Voltage Directive) 2004/108/EC + amendments (Electromagnetic Compatibility)
Air cooling	Forced air cooling with integrated fans
Water cooling	Water-water cooling unit, internal circuit, deionized water
Permissible coolant temperature (raw water)	
• Inlet	+5 ... +35 °C
• Discharge, max.	+40 °C

Rated data		
Output voltage	**3.3 kV**	**4.16 kV**
Input voltage	3.3 kV	4.16 kV
Tolerance of input voltage	±10 %	±10 %
Line frequency	50/60 Hz ± 3 %	50/60 Hz ± 3 %
Line power factor fundamental mode	1	1

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Technical specifications

	Operation of induction motors		Operation of separately excited synchronous motors
	Without speed encoder	With speed encoder	With speed encoder
Control properties			
Operating range			
• Lower limit of speed control range (% of rated motor speed)	5 %	0 %	0 %
• Max. permissible output frequency	250 Hz	250 Hz	90 Hz
• Field-shunting range	1:3	1:3	1:4
Stationary operation			
• Speed accuracy (% of rated motor speed)	± 0.2 % (from 5 % of rated speed)	± 0.01 %	± 0.01 %
• Torque accuracy (% of rated torque)	± 5 % (from 5 % of rated speed)	± 5 %	± 2 %
Dynamic operation			
• Torque rise time	5 ms	5 ms	5 ms

	Storage	Transport	Operation
Climatic ambient conditions			
Ambient temperature	-25 ... +70 °C	-25 ... +70 °C	5 ... 40 °C (air cooling) 5 ... 45 °C (water cooling)
Relative air humidity	5 ... 95 % (only slight condensation permitted; converter must be completely dry before commissioning)	5 ... 75 %	5 ... 85 % (condensation not permissible)
Other climatic conditions in accordance with Class	1K3 according to EN 60721-3-1 (IEC 60721-3-1) (icing not permitted)	2K2 according to EN 60721-3-2 (IEC 60721-3-2)	3K3 according to EN 60721-3-3 (IEC 60721-3-3)
Degree of pollution	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)
Mechanical ambient conditions			
Dynamic stress			
• Deflection	1.5 mm at 2 ... 9 Hz	3.5 mm at 2 ... 9 Hz	0.3 mm at 2 ... 9 Hz
• Acceleration	5 m/s^2 at 9 ... 200 Hz	10 m/s^2 at 9 ... 200 Hz 15 m/s^2 at 200 ... 500 Hz	1 m/s^2 at 9 ... 200 Hz
Other mechanical conditions in accordance with Class (increased strength for marine duty)	1M2 according to EN 60721-3-1 (IEC 60721-3-1)	2M2 according to EN 60721-3-2 (IEC 60721-3-2)	3M1 according to EN 60721-3-3 (IEC 60721-3-3)
Other ambient conditions			
Biological ambient conditions in accordance with Class	1B1 according to EN 60721-3-1 (IEC 60721-3-1)	2B1 according to EN 60721-3-2 (IEC 60721-3-2)	3B2 according to EN 60721-3-3 (IEC 60721-3-3) (without harmful flora)
Chemically active substances in accordance with Class	1C1 according to EN 60721-3-1 (IEC 60721-3-1)	2C1 according to EN 60721-3-2 (IEC 60721-3-2)	3C2 according to EN 60721-3-3 (IEC 60721-3-3) (no occurrence of salt mist)
Mechanically active substances in accordance with Class	1S1 according to EN 60721-3-1 (IEC 60721-3-1)	2S1 according to EN 60721-3-2 (IEC 60721-3-2)	3S1 according to EN 60721-3-3 (IEC 60721-3-3)

Note:

The values specified under storage and transport apply to suitably packed converters.

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Technical specifications

Derating for special installation conditions

Current derating

If the converters are operated at installation altitudes from 1000 m above sea level or at ambient/coolant temperatures > 40 °C for air cooling or with intake temperatures in the cooling unit > 35 °, derating factors k_H or k_T must be taken into account for the rated current (DIN 43671). For the permitted continuous current I:

$I \leq I_N \times k_H \times k_T$

I permitted continuous current

I_N rated current

Current derating as a function of the installation altitude (air cooling)

Derating factor k_H for air cooling

Current derating as a function of the installation altitude (water cooling)

Derating factor k_H for water cooling

Current derating as a function of ambient temperature

Derating factor k_T (ambient temperature)

Current derating as a function of the raw water intake temperature

Derating factor k_T (raw water intake temperature)

Voltage derating

For installation altitudes >2000 m, acc. to EN 60664-1/VDE 0110 (IEC 60664-1) in addition to a current derating, a voltage derating is also required. This depends on the air and creepage distances in the unit.

Voltage derating as a function of installation altitude

Derating factor k_U

Example

Derating data SINAMICS SM150 in IGBT version (water-cooled converter)

Drive unit	6SL3815-7NN38-0AA0
Output voltage	3.3 kV
Input voltage	3.3 kV
Type rating	4600 kVA, 800 A
Installation altitude	2000 m
Raw water intake temperature	40 °C
k_H (water cooling)	0.925
k_T (raw water intake temperature)	0.925
k_U	1.0

For the current, the following applies:

$I \leq I_N \times 0.925 \times 0.925 = I_N \times 0.856$

A current derating of 14.4 % is required.

The maximum available output current is 685 A.

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Technical specifications

SINAMICS SM150 in the IGBT version Air cooling		6SL3810-7NN36-0AA0	6SL3810-7NN38-0AA1	6SL3810-7NP36-0AA0	6SL3810-7NP38-0AA1
Output voltage	kV	3.3		4.16	
Type rating	kVA	3400	4600	4300	5800
Shaft output [1]	kW	2800	3800	3600	4800
	hp	3600	4950	4700	6500
Rated output current	A	600	800	600	800
Input voltage	kV	3.3	3.3	4.16	4.16
Rated input current [1]	A	616	822	616	822
Power loss [2]	kW	76	94	98	118
Efficiency [2]	%	97.3	97.5	97.3	97.5
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [3]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [4]	A	43	43	43	43
Cooling air flow rate	m^3/s	4.7	4.7	4.7	4.7
Sound pressure level L_{pA} (1 m)	dB	85	85	85	85
Measuring surface level L_s (1 m)	dB	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [5] [6]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [5]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP22	IP22	IP22	IP22
Dimensions [7]					
• Width	mm	3020	3020	3020	3020
• Height	mm	2570	2570	2570	2570
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 4/4)	Fig. No.	11	11	11	11
Weight [7]	kg	2850	2850	2850	2850

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with synchronous motors for a power factor cos φ = 1 and a motor efficiency of 96 %. The calculation is based on the rated output current. The rated input current also depends on the line power factor, for which a typical value of 1 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Without cooling system.

[3] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0,6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[4] Additional 20 A precharging current for 25 s.

[5] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit version, Page 4/4.

[6] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[7] The specified dimensions and weights include doors and panels, however no options.

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Technical specifications

SINAMICS SM150 in the IGBT version Water cooling		6SL3815-7NN38-0AA0	6SL3815-7NN41-0AA1	6SL3815-7NP38-0AA0	6SL3815-7NP41-0AA1
Output voltage	kV	3.3		4.16	
Type rating	kVA	4600	5700	5800	7200
Shaft output [1]	kW	3800	4700	4800	5900
	hp	4950	6350	6500	8000
Rated output current	A	800	1000	800	1000
Input voltage	kV	3.3	3.3	4.16	4.16
Rated input current [1]	A	822	1027	822	1027
Power loss [2] [3]	kW	102	115	132	145
Efficiency [3]	%	97.3	97.6	97.3	97.6
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [4]	A	4	4	4	4
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz [5]	A	20	20	20	20
Raw water flow rate	l/min	283	283	283	283
Deionized water requirement, approx.	l	95	95	95	95
Sound pressure level L_{pA} (1 m)	dB	76	76	76	76
Measuring surface level L_s (1 m)	dB	19	19	19	19
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm^2 (DIN VDE)	4 × 240	4 × 240	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM	4 × 500 MCM
Degree of protection		IP43	IP43	IP43	IP43
Dimensions [8]					
• Width	mm	4220	4220	4220	4220
• Height	mm	2280	2280	2280	2280
• Depth	mm	1275	1275	1275	1275
Circuit version (Page 4/4)	Fig. No.	11	11	11	11
Weight [8]	kg	3500	3500	3500	3500

[1] The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with synchronous motors for a power factor cos φ = 1 and a motor efficiency of 96 %. The calculation is based on the rated output current. The rated input current also depends on the line power factor, for which a typical value of 1 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 50. Both approximate values need to be adapted to the motor which is actually used.

[2] Approx. 5 % of the power loss is dissipated in the room.

[3] Without cooling system.

[4] The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0,6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.

When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

[5] Additional 20 A precharging current for 25 s.

[6] Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit version, Page 4/4.

[7] The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

[8] The specified dimensions and weights include doors, panels and cooling unit, however no options.

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Notes

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SINAMICS SM150 in IGCT version

5

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SINAMICS SM150
Medium-Voltage Converter

SINAMICS SM150 in IGCT version

Overview

SINAMICS SM150 in the IGCT version

Water-cooled, regenerative feedback SINAMICS SM150 converters in the IGCT version are available as single or multi-motor drives with the well-proven medium-voltage IGCT power semiconductors. With multi-motor drives, a common DC bus enables the direct exchange of energy in generator and motor applications.

IGCT converters are available for the following voltage and outputs:

Rated output voltage	Max. type rating
3.3 kV	10.5 MVA, 21 MVA, 31.5 MVA (for a single circuit configuration, double or triple parallel circuit configurations)

The rated power in the specific application will depend on the necessary load cycle.

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies, possibly necessary derating for parallel circuit configurations, limits regarding the maximum permissible short-circuit current) please contact your Siemens sales partner indicating the required specifications.

Global use

SINAMICS SM150 converters in the IGCT version are manufactured to international standards and regulations, making them ideally suited for global use. These converters are also available in ship-going form (meeting the requirements of all major classification organizations).

Benefits

- Compact design and highly flexible configuration ensures easy plant integration
- Simple operator control and monitoring from the user-friendly operator panel
- Simple and reliable operation through integrated maintenance functions: The converter signals early on and automatically if maintenance is required or components need to be replaced
- High degree of ruggedness and reliability due to the use of IGCT power semiconductors in the high power range and fuseless design combined with an intelligent response to external disturbances
- Can be easily integrated into automation solutions as the PROFIBUS interface is supplied as standard along with various analog and digital interfaces
- High level of service-friendliness through innovative power unit design with compact phase modules and easy access to all components
- By appropriately engineering the drive system, reactive power can be made available to other drives, therefore helping ensure that the plant or system is cost effective.

Design

Active Line Modules and Motor Modules share an almost identical structure with both the single-motor and the multi-motor drive. Phase modules in which IGCTs, diodes etc. are grouped together in one compact system are used in both.

Single-motor drive

With a single-motor drive in the basic circuit, one Active Line Module and one Motor Module are connected via a DC link.

For greater output ratings, two or three complete converter units with isolated DC links are operated in parallel.

Multi-motor drive

With multi-motor drives, up to six power units are operated on the common DC bus. In addition to the Active Line Module, four Motor Modules with four motors can be operated on the common DC bus where energy can be directly exchanged. In this case, configurations are also possible with two Active Line Modules.

The converter consists of cabinet units for the Active Line Module and for the Motor Module. One of three phase modules and the control section in the Motor Module cabinet unit are highlighted in the illustration.

SINAMICS SM150 in the IGCT version, internal design (without cooling unit)

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Design

Block diagram

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Design

Folgende Schaltungsvarianten stehen für SINAMICS SM150 in IGCT-Ausführung zur Verfügung.

Basic circuit

Two converter units operated in parallel in order to increase the output (with reduction of circuit feedbacks in addition) [1]

Three converter units operated in parallel in order to increase the output (with reduction of circuit feedbacks in addition) [1]

[1] Requires a motor with separate winding systems.

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Design

DC bus configuration with two motors on common DC link

DC bus configuration with three motors on common DC link

DC bus configuration with four motors on a common DC link

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Design

DC bus configuration with two Active Line Modules and three motors on a common DC link

DC bus configuration with two Active Line Modules and four motors on a common DC link

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Design

DC bus configuration with two Active Line Modules and five motors on a common DC link

DC bus configuration with two Active Line Modules and three motors on a common DC link (2 × 10 MVA, 1 × 20 MVA)

For the DC bus configurations with two or more motors, energy can be exchanged along the common DC link between drives that are either motoring or regenerating. This results in savings in the Active Line Module, the transformers and the circuit breakers. These configurations are used mainly for single-stand cold rolling mills with a coiler and for transmission test stands.

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Function

Characteristic features

SINAMICS SM150 in the IGCT version	
Line Module (rectifier on mains side)	
Active Line Module (four-quadrant operation)	Standard
Motor Module (rectifier on motor side)	
Voltage range	3.3 kV
Power range (typ.)	5 ... 31.5 MVA
Cooling method	
• Water cooling	Standard
Control modes	Standard: With encoder
• Induction motor	Standard
• Synchronous motor, separately excited	Option
• Synchronous motor, separately excited, with brushless excitation system	On request
• Synchronous motor, permanently excited	Option
DC bus configuration with several Motor Modules on one common DC bus	Standard

Software and protection functions

SINAMICS SM150 in the IGCT version	Description
Closed-loop control	The motor-side closed-loop control is realized as a field-oriented closed-loop vector control that can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamic performance of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely independently of each other. Prescribed torques can thus be observed and limited accurately. In the speed range from 1:10, the field-oriented closed-loop control does not require an actual speed value encoder. An actual speed value encoder is required in the following scenarios: • High dynamics requirements • Torque control/constant torque drives with a control range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal strip. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with variable smoothing times in the lower and upper speed ranges, improves the control response and therefore prevents mechanical overloading of the drive train. The ramp-down ramps can be parameterized separately for emergency stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Power supply failures are bridged to the extent permitted by the kinetic energy of the drive train. The speed drops depending on the moment of inertia and the load torque. The current speed setpoint is resumed when the power supply returns.
Automatic restart	The automatic restart switches the drive on again when the power is restored after a power failure or a general fault, and ramps up to the current speed setpoint.
Flying restart	The flying restart function permits smooth connection of the converter to a rotating motor.
Diagnostics functions	• Self-diagnosis of control hardware • Non-volatile memory for reliable diagnosis when the power supply fails • Monitoring the IGCTs with individual messages for each mounting location • User-friendly on-site operator panel with plain text messages
Operating hours and switching cycle counter	The switching cycles of the circuit breakers are detected and summed to form the basis for preventive maintenance work.
Operator protection	The cabinet doors of the power units are fitted with electromagnetic locks. This prevents the cabinet doors being opened while hazardous voltages are connected inside the cabinet.

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Function

SINAMICS SM150 in the IGCT version	Description
EMERGENCY-OFF button	The converters are equipped as standard with an EMERGENCY-OFF button with protective collar which is fitted in the cabinet door. The contacts of the button are connected in parallel to the terminal strip so they can be integrated in a protection concept on the plant side. EMERGENCY-OFF stop category 0 is set as standard for an uncontrolled shutdown (DIN EN 60204-1/VDE 0113-1 (IEC 60204-1)). The function includes voltage disconnection of the converter output through the circuit breaker. The motor coasts in the process. The control of the "Safe Torque Off" function is optionally available (option **K80**).
Insulation monitoring	The converters feature insulation monitoring of the complete electrical circuit from the secondary side of the transformer to the stator windings of the motor.
Monitoring of the peripherals	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available. In addition it is possible to monitor the temperature with thermocouples or Pt100 resistors.
Thermal overload protection	An alarm message is issued first when the overtemperature threshold is reached. If the temperature rises further, either a shutdown is carried out or automatic influencing of the output current so that a reduction in the thermal load is achieved. Following elimination of the cause of the fault (e.g. improvement in the ventilation), the original operating values are automatically resumed. In the case of water-cooled converters, the water temperature and flow rate are recorded at several points in the cooling circuit and evaluated. An extensive self-diagnosis protects the converter and reports faults.
Grounding switch (option)	If grounding on the infeed or motor side is required for safety and protection reasons, a motorized grounding switch can be ordered. For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.

SIMATIC OP 177B operator panel

The SIMATIC OP 177B operator panel is fitted into the cabinet door of the SINAMICS SM150 to enable operation, monitoring and commissioning.

It has the following features and characteristics:

- 5.7" STN touch display
- Context-dependent operations by touch, permanently available functions can be selected using individual keys
- Non-volatile message buffer, no battery

English and German are available as operator panel languages.

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Selection and ordering data

Type rating	Shaft output		Rated output current	**SINAMICS SM150 in the IGCT version**	Circuit versions (Pages 5/4 to 5/7)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 3.3 kV					
10000	9600	13000	1750	**6SL3845-7NN41-8AA0**	⑪
20000	19200	26000	2 × 1750	**6SL3845-7NN43-6AA0**	⑫
30000	28800	39000	3 × 1750	**6SL3845-7NN45-4AA0**	⑬
10000 [1]	9600	13000	2 × 1750	**6SL3845-7NN41-8AB0**	⑭
10000 [1]	9600	13000	3 × 1750	**6SL3845-7NN41-8AC0**	⑮
10000 [1]	9600	13000	4 × 1750	**6SL3845-7NN41-8AD0**	⑯
10000 [1]	9600	13000	3 × 1750	**6SL3845-7NN41-8AF0**	⑰
10000 [1]	9600	13000	4 × 1750	**6SL3845-7NN41-8AG0**	⑱
10000 [1]	9600	13000	5 × 1750	**6SL3845-7NN41-8AK0**	⑲
20000 [1]	19200	26000	1 × (2 × 1750) +2 × 1750	**6SL3845-7NN43-6AF0**	⑳
10500	10200	13500	1850	**6SL3845-7NN42-2AA0**	⑪
21000	20400	27000	2 × 1850	**6SL3845-7NN44-5AA0**	⑫
31500	30600	40500	3 × 1850	**6SL3845-7NN46-7AA0**	⑬

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies, possibly necessary derating for parallel circuit configurations, limits regarding the maximum permissible short-circuit current) please contact your Siemens sales partner indicating the required specifications.

[1] The underlying circuits are based on a drive line-up in which the drives operate both as motor and generator. Energy is exchanged via the DC link. The specified power corresponds to the maximum infeed power. The effective total power of the Motor Modules (taking into account the power flow direction) may not exceed this infeed power.

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Options

When ordering a converter with options, add **"-Z"** to the order number of the converter, followed by the order code(s) for the desired option(s).

Example:

6SL3845-1NN41-8AA0-Z
+N06+M10+...

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options	
Circuit breaker at the converter input (on request)	**N13**

Output-side options		**L08**	**L52**	**L72**	**Y73**
Output reactor	**L08**		✓	✓	✓
Circuit breaker at converter output [1]	**L52**	✓		✓	✓
Braking Module (on request)	**L72**	✓	✓		✓
Braking resistor (on request)	**Y73**	✓	✓	✓	

[1] Option **L52** cannot be combined with option **L51** (disconnector at converter output).

Capacitor Modules to increase the DC link capacitance		**N06**	**N07**	**N08**
Capacitor Module to increase the DC link capacitance (1 module)	**N06**		–	–
Capacitor Modules to increase the DC link capacitance (2 modules)	**N07**	–		–
Capacitor Modules to increase the DC link capacitance (3 modules)	**N08**	–	–	

Protective functions		**K80**	**L48**	**L49**	**L51**	**M10**
Control of "Safe Torque Off" function	**K80**		✓	✓	✓	✓
Make-proof grounding switch at converter input (motor-operated)	**L48**	✓		✓	✓	✓
Make-proof grounding switch at converter output (motor-operated)	**L49**	✓	✓		✓	✓
Disconnector at converter output [1]	**L51**	✓	✓	✓		✓
Safety interlocking system	**M10**	✓	✓	✓	✓	

[1] Option **L51** cannot be combined with option **L52** (circuit breaker at converter output).

✓ Options can be combined
– Options are mutually exclusive

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Options

Temperature sensing and evaluation (standard: 3 Pt100 inputs)		L80	L81	L82	L90	L91	L92	L93	L94	L95	L96
2 thermistor motor protection relays for alarm and fault [1]	L80		–	–	✓	✓	✓	✓	✓	✓	✓
2 x 2 thermistor protection relays for alarm and fault[1]	L81	–		–	✓	✓	✓	✓	✓	✓	✓
3 x 2 thermistor protection relays for alarm and fault[1]	L82	–	–		✓	✓	✓	✓	✓	✓	✓
Pt100 evaluation unit with 3 inputs[1]	L90	✓	✓	✓		–	–	–	–	–	–
2 Pt100 evaluation units with 3 inputs each[1]	L91	✓	✓	✓	–		–	–	–	–	–
3 Pt100 evaluation units with 3 inputs each[1]	L92	✓	✓	✓	–	–		–	–	–	–
Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control system)[1]	L93	✓	✓	✓	–	–	–		–	–	–
2 Pt100 evaluation units each with 6 inputs and 2 analog outputs (outputs for display connected to the control system)[2]	L94	✓	✓	✓	–	–	–	–		–	–
Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system)[1]	L95	✓	✓	✓	–	–	–	–	–		–
2 Pt100 evaluation units each with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system)[2]	L96	✓	✓	✓	–	–	–	–	–	–	

[1] Options **L..** cannot be combined with option **G61** (additional TM31 Terminal Module).

[2] Option **L94** and **L96** cannot be combined with options **G61** and **G62** (additional Terminal Modules TM31) as well as with option **E86** (additional analog inputs).

Increased degree of protection of the control cabinets in the water-cooled version (standard: IP43)	
IP54 degree of protection	M54

Controlled motor feeder for auxiliaries [1]		N30	N31	N32	N33
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 4/4.8 kW	N30		–	–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 7/8 kW	N31	–		–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 11/12.7 kW	N32	–	–		–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 15/17.5 kW	N33	–	–	–	

[1] With the ON command at the converter, the contactor is **closed**, and with the OFF command, the contactor is **opened** (example: external fan on the motor). The supply voltage for the auxiliaries must be provided externally.

✓ Options can be combined

– Options are mutually exclusive

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Options

Controlled outgoing feeder for auxiliaries [1]		N35	N36	N37	N38
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 1.2/1 kW	N35		–	–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 2.2/1.5 kW	N36	–		–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 3.5/2.1 kW	N37	–	–		–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 4.5/2.8 kW	N38	–	–	–	

[1] With the ON command at the converter, the contactor is **opened**, and with the OFF command, the contactor is **closed** (example: heater). The supply voltage for the auxiliaries must be provided externally.

Connection of signal cables (standard: signal cable connected directly to the terminals of the Terminal Modules)		M32	M33	M36
Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm²	M32		–	✓
Customer's terminal strip with screw terminals for signal cables up to 2.5 mm²	M33	–		✓
Cable entry, brass for power cables	M36	✓	✓	

Operator control and display instruments in the door of the control cabinet		K20	K21	K22
Indicator lights and Start/Stop button in the cabinet door	K20		–	–
Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights and start/stop buttons	K21	–		–
Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights and start/stop buttons	K22	–	–	

Interface modules for connection to external bus systems (standard: PROFIBUS (Slave))	
PROFINET interface (via CBE30, on request)	G34

Interface modules for additional customer connections		G61	G62	G63
Additional TM31 Terminal Module [1]	G61		✓	✓
Second additional TM31 Terminal Module [1]	G62	✓		✓
Additional TM15 Terminal Module	G63	✓	✓	

[1] For the exclusions for options **G61** and **G62** see the description of the options, Page 6/16.

✓ Options can be combined
– Options are mutually exclusive

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Options

Additional analog inputs/outputs (isolated)		E86	E87
Additional analog inputs (isolated) [1]	E86		✓
Additional analog outputs (isolated) [2]	E87	✓	

[1] Option **E86** cannot be combined with option **G62** (second additional TM31 Terminal Module) as well as with options **L94** and **L96** (2 Pt100 evaluation units).
[2] Option **E87** cannot be combined with option **G62** (second additional TM31 Terminal Module).

Other interface modules		G66	G70	G71
PADU8 diagnostic module (8 analog and 8 digital signals)	G66		✓	✓
Pulse distributor to transfer the speed encoder signal	G70	✓		✓
Optical bus terminal (OBT) for PROFIBUS	G71	✓	✓	

Industry-specific options	
NAMUR terminal strip	B00

Functional options		E00	E01	E02	E03
Control for separately-excited synchronous motors (static excitation unit is provided on the plant side)	E00		–	–	–
Control for separately excited synchronous motors with slipring excitation	E01	–		–	–
Control for separately excited synchronous motors with brushless excitation system (on request)	E02	–	–		–
Control for permanently-excited synchronous motors [1]	E03	–	–	–	

[1] Option **E03** can only be ordered in combination with option **L52** (circuit breaker at the converter output).

Documentation (standard: PDF format in English on CD-ROM)		B43	B44	B45	D02	D15	Y10
Production flowchart: Generated once	B43		–	–	✓	✓	✓
Production flowchart: Updated every two weeks	B44	–		–	✓	✓	✓
Production flowchart: Updated every month	B45	–	–		✓	✓	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	D02	✓	✓	✓		✓	✓
One set of printed documentation (multiple orders possible)	D15	✓	✓	✓	✓		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	Y10	✓	✓	✓	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

✓ Options can be combined
– Options are mutually exclusive

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Options

Documentation in languages (standard: PDF format in English on CD-ROM)		D00	D55	D56	D57	D72	D76	D77	D78	D79	D84
Documentation in German	D00		–	–	–	–	✓	–	–	–	–
Documentation in Polish	D55	–		–	–	–	✓	–	–	–	–
Documentation in Russian	D56	–	–		–	–	✓	–	–	–	–
Documentation in Japanese (on request)	D57			–		–	✓	–	–	–	–
Documentation in Italian (on request)	D72	–	–	–	–		✓	–	–	–	–
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French	D77	–	–	–	–	–	✓		–	–	–
Documentation in Spanish	D78	–	–	–	–	–	✓	–		–	–
Documentation in Portuguese (Brazil)	D79	–	–	–	–	–	✓	–	–		–
Documentation in Chinese	D84	–	–	–	–	–	✓	–	–	–	

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91
Rating plate in English/French	T58		–	–	–	–	–	–	–
Rating plate in English/Spanish	T60	–		–	–	–	–	–	–
Rating plate in English/Italian	T80	–	–		–	–	–	–	–
Rating plate in English/Portuguese (on request)	T82	–	–	–		–	–	–	–
Rating plate in English/Russian (on request)	T85	–	–	–	–		–	–	–
Rating plate in English/Polish (on request)	T86	–	–	–	–	–		–	–
Rating plate in English/Japanese (on request)	T90	–	–	–	–	–	–		–
Rating plate in English/Chinese (on request)	T91	–	–	–	–	–	–	–	

Converter acceptance inspections in presence of customer		F03	F73	F77	F79	F97
Visual acceptance of converter	F03		–	–	–	–
Functional acceptance of converter with inductive load (on request)	F73	–		✓	✓	–
Acceptance of the converter insulation test (on request) [1]	F77	–	✓		✓	–
Test of the interface between the converter and customer equipment (5 hours, on request) [1]	F79	–	✓	✓		–
Customer-specific system acceptance tests (on request)	F97	–	–	–	–	

[1] Options **F77** and **F79** can only be ordered in conjunction with option **F73** .

✓ Options can be combined
– Options are mutually exclusive

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Options

Cooling unit (standard: Cooling unit with redundant pumps and a		W02	W11	W12	W14	Y40
Cooling unit with redundant stainless steel plate-type heat exchangers	W02		–	–	–	–
Cooling unit with titanium plate-type heat exchanger	W11	–		–	–	–
Cooling unit with redundant titanium plate-type heat exchangers	W12	–	–		–	–
Converter without cooling unit (provided on the system side)	W14	–	–	–		–
Raw water data that deviates from the technical data (on request) [1]	Y40	–	–	–	–	

[1] Option **Y40** includes a cooling system which is adapted to the raw water data according to the customer's specifications.

Extension of the liability for defects		Q80	Q81	Q82	Q83	Q84	Q85
Extension of the liability for defects period by 12 months to a total of 24 months (2 years) after being delivered	Q80		–	–	–	–	–
Extension of the liability for defects period by 18 months to a total of 30 months (2.5 years) after being delivered	Q81	–		–	–	–	–
Extension of the liability for defects period by 24 months to a total of 36 months (3 years) after being delivered	Q82	–	–		–	–	–
Extension of the liability for defects period by 30 months to a total of 42 months (3.5 years) after being delivered	Q83	–	–	–		–	–
Extension of the liability for defects period by 36 months to a total of 48 months (4 years) after being delivered	Q84	–	–	–	–		–
Extension of the liability for defects period by 48 months to a total of 60 months (5 years) after being delivered	Q85	–	–	–	–	–	

Miscellaneous options		L50	L55	Y05	Y09
Cabinet lighting and service socket in the control section	L50		✓	✓	✓
Anti-condensation heating for the cabinet	L55	✓		✓	✓
Customer-specific rating plate	Y05	✓	✓		✓
Special paint finish acc. to RAL.... (in a color other than RAL 7035; plain text required)	Y09	✓	✓	✓	

✓ Options can be combined
– Options are mutually exclusive

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Technical specifications

General technical data	
Power components	IGCTs
Line-side converter	Regulated, self-commutating feed/feedback unit (Active Line Module)
Motor-side conveter	Inverter (Motor Module)
Closed-loop control	Closed-loop vector control
Drive quadrants	4 (driving and braking per 2 directions of rotation)
Electrical isolation, power unit/ open-loop and closed-loop control	Fiber-optic cable, isolating transformer
Auxiliary power supply (for fans, coolant pumps, precharging the DC link capacitors, open-loop and closed-loop control)	230 V 1 AC ±10 %, 50/60 Hz ±3 % and 400 V 3 AC ±10 %, 50/60 Hz ±3 %
Installation altitude	≤ 1000 m above sea level: 100 % load capability > 1000 ... 4000 m above sea level: current derating required > 2000 ... 4000 m above sea level: voltage derating required in addition
Insulation	According to EN 50178/VDE 0160 (IEC 62103): Pollution degree 2 (without conductive pollution), condensation not permissible
Degree of protection	According to EN 60529/VDE 0470 T1 (IEC 60529): IP43
Protection class	I acc. to EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)
Shock-hazard protection	EN 50274/VDE 0660 T514 and BGV A3 when used for the intended application
Interference transmission	This drive unit is part of a PDS, Category C4 acc. to EN 61800-3/VDE 0160 T103 (IEC 61800-3). It has not been designed to be connected to the public line supply. EMC disturbances can occur when connected to these line supplies. The essential requirements placed on EMC protection for the drive system should be secured using an EMC plan on the customer side.
Paint finish/color	Indoor requirements/RAL 7035, light gray
Applicable standards and directives	
• Standards	EN 61800-3/VDE 0160 T103 (IEC 61800-3) EN 61800-4/VDE 0160 T104 (IEC 61800-4), however, only if referenced in the standards EN 61800-3 or EN 61800-5-1 EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1) EN 60146-1-1/VDE 0558 T11 (IEC 60146-1-1) EN 50178/VDE 0160 (IEC 62103) EN 60204-11/VDE 0113 T11 (IEC 60204-11), however, structuring principles and reference marking according to EN 61346-1 instead of EN 81346-1
• EU directives	2006/95/EC + amendments (Low Voltage Directive) 2004/108/EC + amendments (Electromagnetic Compatibility)
Water cooling	Water-water cooling unit, internal circuit, deionized water
Permissible coolant temperature (raw water)	
• Inlet	5 ... 35 °C
• Discharge, max.	40 °C

Rated data	
Output voltage	**3.3 kV**
Input voltage	3.3 kV
Tolerance of input voltage	±10 %
Line frequency	50/60 Hz ± 3 %
Line power factor fundamental mode	1

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Technical specifications

	Operation of induction motors		Operation of separately excited synchronous motors
	Without speed encoder	With speed encoder	With speed encoder
Control properties			
Operating range			
• Lower limit of speed control range (% of rated motor speed)	5 %	0 %	0 %
• Max. permissible output frequency	250 Hz	250 Hz	90 Hz
• Field-weakening range	1:3	1:3	1:4
Stationary operation			
• Speed accuracy (% of rated motor speed)	±0.2 % (from 5 % of rated speed)	±0.01 %	±0.01 %
• Torque accuracy (% of rated torque)	±5 % (from 5 % of rated speed)	±5 %	±2 %
Dynamic operation			
• Torque rise time	5 ms	5 ms	5 ms

	Storage	Transport	Operation
Climatic ambient conditions			
Ambient temperature	-25 ... +70 °C	-25 ... +70 °C	5 ... 45 °C
Relative air humidity	5 ... 95 % (only slight condensation permitted; converter must be completely dry before commissioning)	5 ... 75 %	5 ... 85 % (condensation not permissible)
Other climatic conditions in accordance with Class	1K3 according to EN 60721-3-1 (IEC 60721-3-1) (icing not permitted)	2K2 according to EN 60721-3-2 (IEC 60721-3-2)	3K3 according to EN 60721-3-3 (IEC 60721-3-3)
Degree of pollution	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)
Mechanical ambient conditions			
Vibratory load			
• Deflection	1.5 mm at 2 ... 9 Hz	3.5 mm at 2 ... 9 Hz	0.3 mm at 2 ... 9 Hz
• Acceleration	5 m/s^2 at 9 ... 200 Hz	10 m/s^2 at 9 ... 200 Hz 15 m/s^2 at 200 ... 500 Hz	1 m/s^2 at 9 ... 200 Hz
Other mechanical conditions in accordance with Class (increased strength for marine duty)	1M2 acc. to DIN EN 60721-3-1 (IEC 60721-3-1)	2M2 acc. to DIN EN 60721-3-2 (IEC 60721-3-2)	3M1 acc. to DIN EN 60721-3-3 (IEC 60721-3-3)
Other ambient conditions			
Biological ambient conditions in accordance with Class	1B1 according to EN 60721-3-1 (IEC 60721-3-1)	2B1 according to EN 60721-3-2 (IEC 60721-3-2)	3B2 according to EN 60721-3-3 (IEC 60721-3-3) (without harmful flora)
Chemically active substances in accordance with Class	1C1 according to EN 60721-3-1 (IEC 60721-3-1)	2C1 according to EN 60721-3-2 (IEC 60721-3-2)	3C2 according to EN 60721-3-3 (IEC 60721-3-3) (no occurrence of salt mist)
Mechanically active substances in accordance with Class	1S1 according to EN 60721-3-1 (IEC 60721-3-1)	2S1 according to EN 60721-3-2 (IEC 60721-3-2)	3S1 according to EN 60721-3-3 (IEC 60721-3-3)

Note:

The values specified under storage and transport apply to suitably packed converters.

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Technical specifications

Derating for special installation conditions

Current derating

If the converters are operated at installation altitudes above 1000 m above sea level or at deionized water temperatures > 40 °C or raw water temperatures > 35 °, derating factors k_H or k_T must be taken into account for the rated output current (DIN 43671). For the permitted continuous current I:

$I \leq I_N \times k_H \times k_T$

I permitted continuous current

I_N rated current

Current derating as a function of the installation altitude (water cooling)

Derating factor k_H for water cooling

Current derating as a function of the raw water intake temperature

Derating factor k_T (raw water intake temperature)

Voltage derating

For installation altitudes >2000 m, acc. to EN 60664-1/VDE 0110 (IEC 60664-1) in addition to a current derating, a voltage derating is also required. This depends on the air and creepage distances in the unit.

Voltage derating as a function of installation altitude

Derating factor k_U

Example

Derating data SINAMICS SM150 in IGCT version

Drive unit	6SL3845-7NN41-8AA0
Output voltage	3.3 kV
Input voltage	3.3 kV
Type rating	10000 kVA, 1750 A
Installation altitude	2000 m
Raw water intake temperature	40 °C
k_H (water cooling)	0.925
k_T (raw water intake temperature)	0.925
k_U	1.0

For the current, the following applies:

$I \leq I_N \times 0.925 \times 0.925 = I_N \times 0.856$

A current derating of 14.4 % is required.

The maximum available output current is 1497 A.

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SINAMICS SM150
Medium-Voltage Converter

SINAMICS SM150 in IGCT version
Water cooling

Technical specifications

SINAMICS SM150 in the IGCT version Water cooling		6SL3845-7NN41-8AA0	6SL3845-7NN43-6AA0	6SL3845-7NN45-4AA0	6SL3845-7NN41-8AB0	6SL3845-7NN41-8AC0
Output voltage 3.3 kV						
Type rating	kVA	10000	20000	30000	10000	10000
Shaft output [1]	kW	9600	19200	28800	9600 [2]	9600 [2]
	hp	13000	26000	39000	13000 [2]	13000 [2]
Rated output current	A	1750	2 × 1750	3 × 1750	2 × 1750	3 × 1750
Input voltage	kV	3.3	2 × 3.3	3 × 3.3	3.3	3.3
Rated input current [1]	A	1770	2 × 1770	3 × 1770	1770	1770
Power loss [3] [4]	kW	100	200	300	150	225
Efficiency [4]	%	99.0	99.0	98.9	99.3	99.2
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [5]	A	6	12	18	9	12
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	17	20	23	19	20
Precharging current demand, briefly for approx. 25 s	A	20	40	60	22	24
Raw water flow rate	l/min	333	667	1000	667	667
Deionized water requirement, approx.	l	150	250	300	225	250
Sound pressure level L_{pA} (1 m)	dB	75	77	79	76	77
Measuring surface level L_s (1 m)	dB	22	23	24	22.5	23
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm^2 (DIN VDE)	2 × 120	2 × 120	2 × 120	2 × 120	2 × 120
	AWG/MCM (NEC, CEC)	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43
Dimensions [8]						
• Width	mm	5800	10700	15800	8400	10700
• Height [9]	mm	2540	2540	2540	2540	2540
• Depth	mm	1600	1600	1600	1600	1600
Circuit version (Pages 5/4 and 5/5)	Fig. No.	⑪	⑫	⑬	⑭	⑮
Weight [8]	kg	6700	12100	17500	9400	12100

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies, possibly necessary derating for parallel circuit configurations) please contact your Siemens sales partner indicating the required specifications. Additional DC bus configurations are available on request.

Footnotes see page 5/23.

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Technical specifications

SINAMICS SM150 in the IGCT version Water cooling		6SL3845-7NN41-8AD0	6SL3845-7NN41-8AF0	6SL3845-7NN41-8AG0	6SL3845-7NN41-8AK0	6SL3845-7NN43-6AF0
Output voltage 3.3 kV						
Type rating	kVA	10000	10000	10000	10000	20000
Shaft output [1]	kW	9600 [2]	9600 [2]	9600 [2]	9600 [2]	19200 [2]
	hp	13000 [2]	13000 [2]	13000 [2]	13000 [2]	26000 [2]
Rated output current	A	4 × 1750	3 × 1750	4 × 1750	5 × 1750	1 × (2 × 1750) +2 × 1750
Input voltage	kV	3.3	2 × 3.3	2 × 3.3	2 × 3.3	2 × 3.3
Rated input current [1]	A	1770	2 × 1770	2 × 1770	2 × 1770	2 × 1770
Power loss [3] [4]	kW	250	250	300	350	300
Efficiency [4]	%	97.5	97.5	97	99	98.4
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [5]	A	15	15	18	21	18
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	22	22	23	24	23
Precharging current demand, briefly for approx. 25 s	A	20	40	40	40	40
Raw water flow rate	l/min	1000	1000	1000	1333	1000
Deionized water requirement, approx.	l	275	275	300	350	300
Sound pressure level L_{pA} (1 m)	dB	78	78	79	79	79
Measuring surface level L_s (1 m)	dB	24	24	24	24	24
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm^2 (DIN VDE)	2 × 120	2 × 120	2 × 120	2 × 120	2 × 120
	AWG/MCM (NEC, CEC)	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM
Degree of protection		IP43	IP43	IP43	IP43	IP43
Dimensions [8]						
• Width	mm	13500	13500	15800	18100	15800
• Height [9]	mm	2540	2540	2540	2540	2540
• Depth	mm	1600	1600	1600	1600	1600
Circuit version (Pages 5/5 to 5/7)	Fig. No.	⑯	⑰	⑱	⑲	⑳
Weight [8]	kg	14800	14800	17500	20200	17500

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies, possibly necessary derating for parallel circuit configurations) please contact your Siemens sales partner indicating the required specifications. Additional DC bus configurations are available on request.

Footnotes see page 5/23.

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SINAMICS SM150
Medium-Voltage Converter

SINAMICS SM150 in IGCT version
Water cooling

Technical specifications

SINAMICS SM150 in the IGCT version Water cooling		6SL3845-7NN42-2AA0	6SL3845-7NN44-5AA0	6SL3845-7NN46-7AA0
Output voltage 3.3 kV				
Type rating	kVA	10500	21000	31500
Shaft output [1]	kW	10200	20400	30600
	hp	13500	27000	40500
Rated output current	A	1850	2 × 1850	3 × 1850
Input voltage	kV	3.3	2 × 3.3	3 × 3.3
Rated input current [1]	A	1870	2 × 1870	3 × 1870
Power loss [3] [4]	kW	150	300	450
Efficiency [4]	%	98.6	98.6	98.6
Typ. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [5]	A	6	12	18
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	17	20	23
Precharging current demand, briefly for approx. 25 s	A	20	40	60
Raw water flow rate	l/min	333	667	1000
Deionized water requirement, approx.	l	150	250	300
Sound pressure level L_{pA} (1 m)	dB	75	77	79
Measuring surface level L_s (1 m)	dB	22	23	24
Cable cross-sections, line-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase [6] [7]	mm² (DIN VDE)	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
PE connection, max. connection cross-section at the enclosure with M12 screw [6]	mm² (DIN VDE)	2 × 120	2 × 120	2 × 120
	AWG/MCM (NEC, CEC)	2 × 250 MCM	2 × 250 MCM	2 × 250 MCM
Degree of protection		IP43	IP43	IP43
Dimensions [8]				
• Width	mm	5800	10700	15800
• Height[9]	mm	2540	2540	2540
• Depth	mm	1600	1600	1600
Circuit version (Page 5/4)	Fig. No.	11	12	13
Weight [8]	kg	6700	12100	17500

Note:

For other technical requirements that have to be taken into consideration (surge loads, operation at low frequencies, possibly necessary derating for parallel circuit configurations) please contact your Siemens sales partner indicating the required specifications. Additional DC bus configurations are available on request.

Footnotes see page 5/23.

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Technical specifications

1) The data for the rated input current and the power data in hp and kW are approximate values only; these have been calculated for operation with synchronous motors for a power factor cos phi = 1 and a motor efficiency of 96%. The calculation is based on the rated output current. The rated input current also depends on the line power factor, for which a typical value of 1 was assumed.
The hp data are based on the NEC and CEC guidelines for the North American market. The kW values are specified in multiples of 500. Both approximate values need to be adapted to the motor which is actually used.

2) The underlying circuits are based on a drive line-up in which the drives operate both as motor and generator. Energy is exchanged via the DC link. The specified power corresponds to the maximum infeed power. The effective total power of the Motor Modules (taking into account the power flow direction) may not exceed this infeed power.

3) Approx. 5 % of the power loss is dissipated in the room.

4) Without cooling system

5) The typical current drawn (rms value; cos $\varphi_{typ.}$ = 0,6) of the supply for the converter open-loop/closed-loop control is specified. The separate supplies for the socket outlets/light or switched auxiliary power feeders (options **N35 to N38**) have not been taken into account. Values for the typical current drawn for special configurations (e.g. for dimensioning an upstream UPS) are available on request.
When using options **L48** (make-proof grounding switch at the converter input), **L49** (make-proof grounding switch at the converter output) or **L51** (disconnector at the converter output), it should further be taken into account that for switching operations, additional peak values of up to 10 A can occur for each make-proof grounding switch or disconnector. This corresponds to the starting current of a motor used to operate a switch, which decays from approx. 10 A to approx. 2 A in 200 ms. A switching operation takes a total time of approx. 2 s. All optionally used make-proof grounding switches or disconnectors are controlled via the manually-actuated make-proof grounding switch for the converter DC link (standard) and therefore switch simultaneously!

6) Data refer to a sub-system; for details about the number of sub-systems to be connected on the line or motor side, see Circuit versions, Pages 5/4 and 5/5.

7) The maximum permissible cable lengths must be observed (see Power cables, Page 9/13).

8) The specified dimensions and weights include doors, panels and cooling unit, however no options.

9) Depending on the pressure equalization tank, the cooling unit can have a maximum cabinet height of 2790 mm.

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Notes

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Description of options

6

6/2 **Overview**

Description

6/9 Option B00

6/10 Options B43 to B45, C30 to C49

6/11 Options C55, D00 to D84

6/12 Options E00 to E86

6/13 Options E87, F03 to F97

6/14 Options F28 to F76

6/15 Options G20 to G35

6/16 Option G61

6/19 Option G62

6/20 Options G63 to G71

6/21 Options K20 to K80

6/22 Options L08 to L29

6/23 Option L32

6/24 Options L48 and L49

6/25 Options L50 to L53

6/26 Options L55 and L60

6/27 Option L72

6/28 Options L80 and L81

6/29 Options L82 to L90

6/30 Options L91 and L92

6/31 Options L93 and L94

6/32 Options L95 and L96

6/33 Options M10 to M33

6/34 Options M34 to M61

6/35 Options M64 and M66

6/36 Options M78, N06 to N08

6/37 Options N13 and N15

6/39 Options N20 to N33

6/40 Options N35 to N38, Q80 to Q85, S05, T58 to T91

6/41 Options W02 to W20, Y05 to Y10

6/42 Options Y15 to Y73

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Overview

The following tables contain a complete overview of the availability of options for the four converter versions, SINAMICS GM150 and SINAMICS GM150 in the IGBT and IGCT versions.

Information on the possibility of combining various options can be taken from the matrices in Chapters 2, 3, 4 and 5.

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
B00	NAMUR terminal strip	✓	✓	✓	✓
B43	Documentation, production flowchart: Generated once	✓	✓	✓	✓
B44	Documentation, production flowchart: Updated every two weeks	✓	✓	✓	✓
B45	Documentation, production flowchart: Updated every month	✓	✓	✓	✓
C30	Auxiliary voltage 50 Hz 200 V 3 AC	✓	✓	✓	–
C33	Auxiliary voltage 60 Hz 220 V 3 AC	✓	✓	✓	–
C34	Auxiliary voltage 60 Hz 230 V 3 AC	✓	✓	✓	–
C35	Auxiliary voltage 60 Hz 240 V 3 AC	✓	✓	✓	–
C36	Auxiliary voltage 50 Hz 380 V 3 AC	✓	✓	✓	–
C37	Auxiliary voltage 60 Hz 380 V 3 AC	✓	✓	✓	–
C38	Auxiliary voltage 50 Hz 400 V 3 AC	✓	✓	✓	–
C39	Auxiliary voltage 50 Hz 415 V 3 AC	✓	✓	✓	–
C40	Auxiliary voltage 60 Hz 440 V 3 AC	✓	✓	✓	–
C41	Auxiliary voltage 60 Hz 460 V 3 AC	✓	✓	✓	–
C42	Auxiliary voltage 60 Hz 480 V 3 AC	✓	✓	✓	–
C43	Auxiliary voltage 50 Hz 500 V 3 AC	✓	✓	✓	–
C44	Auxiliary voltage 50 Hz 550 V 3 AC	✓	✓	✓	–
C46	Auxiliary voltage 60 Hz 575 V 3 AC	✓	✓	✓	–
C48	Auxiliary voltage 50 Hz 690 V 3 AC	✓	✓	✓	–
C49	Auxiliary voltage 60 Hz 690 V 3 AC	✓	✓	✓	–
C55	Auxiliary voltage 120 V 1 AC for open-loop and closed-loop control	✓	✓	✓	–

✓	Options that can be ordered
–	Options that cannot be ordered

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Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
D00	Documentation in German	✓	✓	✓	✓
D02	Circuit diagrams, terminal diagrams and dimension drawings in DXF format	✓	✓	✓	✓
D15	One set of printed documentation	✓	✓	✓	✓
D55	Documentation in Polish	✓	✓	✓	✓
D56	Documentation in Russian	✓	✓	✓	✓
D57	Documentation in Japanese	On request	On request	On request	On request
D72	Documentation in Italian	On request	On request	On request	On request
D76	Documentation in English	✓	✓	✓	✓
D77	Documentation in French	✓	✓	✓	✓
D78	Documentation in Spanish	✓	✓	✓	✓
D79	Documentation in Portuguese (Brazil)	✓	✓	✓	✓
D84	Documentation in Chinese	✓	✓	✓	✓
E00	Control for separately-excited synchronous motors	✓	✓	✓	✓
E01	Control for separately excited synchronous motors with slipring excitation	On request	On request	✓	✓
E02	Control for separately excited synchronous motors with brushless reverse field excitation	On request	On request	On request	On request
E03	Control for permanently-excited synchronous motors	On request	On request	On request	✓
E11	Suitable for marine use with individual certificate from Germanische Lloyd (GL)	Only for water cooling	✓	–	–
E21	Suitable for marine use with individual certificate from Lloyds Register (LR)	Only for water cooling	✓	–	–
E31	Suitable for marine use with individual certificate from Bureau Veritas (BV)	Only for water cooling	✓	–	–
E51	Suitable for marine use with individual certificate from Det Norske Veritas (DNV)	Only for water cooling	✓	–	–
E61	Suitable for marine use with individual certificate from the American Bureau of Shipping (ABS)	Only for water cooling	✓	–	–
E71	Suitable for marine use with individual certificate from the Chinese Classification Society (CCS)	Only for water cooling	✓	–	–
E82	Increased frequency (converter for high-speed rotors)	✓	–	–	–
E86	Additional analog inputs	✓	✓	✓	✓
E87	Additional analog outputs	✓	✓	✓	✓

✓	Options that can be ordered
–	Options that cannot be ordered

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Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
F03	Visual acceptance, with the customer present	✓	✓	✓	✓
F28	Noise measurement under no-load conditions, without the customer present	Only for air cooling	–	Only for air cooling	–
F29	Noise measurement under no-load conditions, with the customer present	Only for air cooling	–	Only for air cooling	–
F72	Functional acceptance of converter with inductive load, without the customer present	✓	✓	✓	✓
F73	Functional acceptance of converter with inductive load, with the customer present	✓	✓	✓	✓
F76	Acceptance of the converter insulation test, without the customer present	✓	✓	✓	✓
F77	Acceptance of the converter insulation test, with the customer present	✓	✓	✓	✓
F79	Test of the interface between the converter and customer equipment, with the customer present (5 hours)	✓	✓	✓	✓
F97	Customer-specific system acceptance tests	On request	On request	On request	On request
G20	CAN bus interface	On request	On request	–	–
G21	Modbus Plus interface	On request	On request	–	–
G22	Modbus RTU slave interface	On request	On request	–	–
G23	DeviceNet interface	On request	On request	–	–
G24	PROFINET interface (via CBE20)	On request	On request	–	–
G25	TeleService connection TS Adapter II analog modem	✓	–	–	–
G34	PROFINET interface (via CBE30)	–	–	–	On request
G35	TeleService connection TS Adapter II ISDN modem	✓	–	–	–
G30	PROFIBUS master	Only for static excitation unit	Only for static excitation unit	–	–
G61	Additional TM31 Terminal Module	✓	✓	✓	✓
G62	Second additional TM31 Terminal Module	✓	✓	✓	✓
G63	Additional TM15 Terminal Module	✓	✓	✓	✓
G66	PADU8 diagnostics module	–	✓	✓	✓
G70	Pulse distributor to transfer the speed encoder signal	On request	On request	✓	✓
G71	Optical bus terminal (OBT) for PROFIBUS	On request	On request	✓	✓

✓	Options that can be ordered
–	Options that cannot be ordered

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Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
K20	Indicator lights in the cabinet door	✓	✓	✓	✓
K21	Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights	✓	✓	✓	✓
K22	Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights	✓	✓	✓	✓
K50	Sensor Module Cabinet-Mounted SMC30	✓	✓	Included as standard	Included as standard
K80	Control of "Safe Torque Off" function	On request	On request	✓	✓
L08	Output reactor	✓	✓	✓	✓
L21	Overvoltage protection AC	Only for static excitation unit	Only for static excitation unit	–	Only for static excitation unit
L29	Bidirectional synchronized bypass operation	Only with induction motor	–	–	–
L32	Automatic restart	✓	✓	Included as standard (VSM10 and software functionality)	
L48	Make-proof grounding switch at converter input	✓	✓	On request	✓
L49	Make-proof grounding switch at converter output	✓	✓	On request	✓
L50	Cabinet lighting and service socket in the control section	✓	✓	✓	✓
L51	Disconnector at the converter output	✓	✓	✓	✓
L52	Circuit breaker at converter output	✓	✓	✓	✓
L53	UPS for the power supply of the open-loop and closed-loop control	On request	On request	–	–
L55	Anti-condensation heating for the cabinet	✓	✓	✓	✓
L60	EMERGENCY-STOP, Stop Category 1 for controlled stopping	✓	✓	–	–
L72	Braking Module	✓	✓	On request	On request
L80	2 thermistor protection relays for alarm and fault	✓	✓	✓	✓
L81	2 x 2 thermistor protection relays for alarm and fault	✓	✓	✓	✓
L82	3 x 2 thermistor protection relays for alarm and fault	✓	✓	✓	✓
L87	Rotor ground fault monitoring	Only for static excitation unit	Only for static excitation unit	–	Only for static excitation unit

✓	Options that can be ordered
–	Options that cannot be ordered

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Description of options
SINAMICS GM150, SINAMICS SM150

Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
L90	Pt100 evaluation unit with 3 inputs	✓	✓	✓	✓
L91	2 Pt100 evaluation units, each with 3 inputs	✓	✓	✓	✓
L92	3 Pt100 evaluation units, each with 3 inputs	–	✓	✓	✓
L93	Pt100 evaluation unit with 6 inputs and 2 analog outputs	✓	✓	✓	✓
L94	2 Pt100 evaluation units each with 6 inputs and 2 analog outputs	–	✓	✓	✓
L95	Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs	✓	✓	✓	✓
L96	2 Pt100 evaluation units each with 6 inputs for explosion-protected motors and each with 2 analog outputs	–	✓	✓	✓
M10	Safety interlocking system	✓	✓	✓	✓
M11	Dust protection	Only for air cooling	–	Only for air cooling	Included as standard
M13	Power cable connected at the converter input from the top	✓	–	–	–
M16	Extended dust protection	Only for water cooling	–	–	–
M32	Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm^2	✓	✓	✓	✓
M33	Customer's terminal strip with screw terminals for signal cables up to 2.5 mm^2	✓	✓	✓	✓
M34	Auxiliary voltage and signal cables connected from the top	✓	–	–	–
M36	Cable entry, brass for power cables	✓	✓	–	✓
M42	IP42 degree of protection	Only for air cooling	–	–	–
M54	IP54 degree of protection	Only for water cooling	✓	–	✓
M61	Redundant fan in the power unit	✓	–	–	–
M64	Converter prepared for connection to an external air discharge system, with internal cabinet fans	Only for air cooling	–	–	–
M66	Suitable for marine applications	Only for water cooling	✓	–	–
M78	Power cable connected at the converter output from the top	✓	–	–	–

✓	Options that can be ordered
–	Options that cannot be ordered

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Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
N06	Capacitor Module to increase the DC link capacitance (1 module)	–	–	–	✓
N07	Capacitor Modules to increase the DC link capacitance (2 modules)	–	–	–	✓
N08	Capacitor Modules to increase the DC link capacitance (3 modules)	–	–	–	✓
N13	Circuit breaker at the converter input	24-pulse on request only	Not for parallel circuit configuration	–	On request
N15	24-pulse Basic Line Module	✓	✓	–	–
N20	Capacitor tripping device 110 V to 120 V DC	✓	–	–	–
N21	Capacitor tripping device 230 V DC	✓	–	–	–
N22	Input-side switch	Only for static excitation unit	Only for static excitation unit	–	Only for static excitation unit
N30	Controlled motor feeder for auxiliaries 400 V 3 AC/480 V 3 AC, max. 4/4.8 kW	✓	✓	✓	✓
N31	Controlled motor feeder for auxiliaries 400 V 3 AC/480 V 3 AC, max. 7/8 kW	✓	✓	✓	✓
N32	Controlled motor feeder for auxiliaries 400 V 3 AC/480 V 3 AC, max. 11/12.7 kW	✓	✓	✓	✓
N33	Controlled motor feeder for auxiliaries 400 V 3 AC/480 V 3 AC, max. 15/17.5 kW	✓	✓	✓	✓
N35	Controlled outgoing feeder for auxiliaries 230 V 1 AC/120 V 1 AC, max. 1.2/1 kW	✓	✓	✓	✓
N36	Controlled outgoing feeder for auxiliaries 230 V 1 AC/120 V 1 AC, max. 2.2/1.5 kW	✓	✓	✓	✓
N37	Controlled outgoing feeder for auxiliaries 230 V 1 AC/120 V 1 AC, max. 3.5/2.1 kW	✓	✓	✓	✓
N38	Controlled outgoing feeder for auxiliaries 230 V 1 AC/120 V 1 AC, max. 4.5/2.8 kW	✓	✓	✓	✓
Q80	Extension of the liability for defects period by 12 months to a total of 24 months (2 years) after being delivered	✓	✓	✓	✓
Q81	Extension of the liability for defects period by 18 months to a total of 30 months (2.5 years) after being delivered	✓	✓	✓	✓
Q82	Extension of the liability for defects period by 24 months to a total of 36 months (3 years) after being delivered	✓	✓	✓	✓
Q83	Extension of the liability for defects period by 30 months to a total of 42 months (3.5 years) after being delivered	✓	✓	✓	✓
Q84	Extension of the liability for defects period by 36 months to a total of 48 months (4 years) after being delivered	✓	✓	✓	✓
Q85	Extension of the liability for defects period by 48 months to a total of 60 months (5 years) after being delivered	✓	✓	✓	✓

✓ Options that can be ordered

– Options that cannot be ordered

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Description of options
SINAMICS GM150, SINAMICS SM150

Overview

Order code	Option	SINAMICS GM150		SINAMICS SM150	
		IGBT version	IGCT version	IGBT version	IGCT version
S05	Basic configuration	–	–	✓	✓
T58	Rating plate in English/French	✓	✓	✓	✓
T60	Rating plate in English/Spanish	✓	✓	✓	✓
T80	Rating plate in English/Italian	✓	✓	✓	✓
T8^2	Rating plate in English/Portuguese	On request	On request	On request	On request
T85	Rating plate in English/Russian	On request	On request	On request	On request
T86	Rating plate in English/Polish	On request	On request	On request	On request
T90	Rating plate in English/Japanese	On request	On request	On request	On request
T91	Rating plate in English/Chinese	On request	On request	On request	On request
W02	Cooling unit with redundant stainless steel plate-type heat exchangers	Only for water cooling	✓	Only for water cooling	✓
W11	Cooling unit with titanium plate-type heat exchanger	Only for water cooling	✓	Only for water cooling	✓
W12	Cooling unit with redundant titanium plate-type heat exchangers	Only for water cooling	✓	Only for water cooling	✓
W14	Converter without cooling unit, provided on the plant side	Only for water cooling	✓	Only for water cooling	✓
W20	Raw-water connection from the bottom	Only for water cooling	Included as standard	–	Included as standard
Y05	Customer-specific rating plate	✓	✓	✓	✓
Y09	Special paint finish according to RAL...	✓	✓	✓	✓
Y10	Customer-specific circuit diagrams	✓	✓	✓	✓
Y15	Sine-wave filter	✓	–	On request	–
Y17	Line reactor	Only for static excitation unit	Only for static excitation unit	–	Only for static excitation unit
Y40	Raw-water data that deviates from the catalog data	Only for water cooling, on request	On request	–	On request
Y73	Braking resistor	✓	✓	On request	On request

✓ Options that can be ordered

– Options that cannot be ordered

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Options

To enable the required description to be found more easily, the following option descriptions are sorted alphabetically by order codes. If an option is only available for certain converter configurations, this is indicated in brackets after the option title.

Note:

An option can only be ordered once per converter, if not explicitly specified otherwise.

Note:

The "on request" comment can have the following meanings:

- The price has not been defined and must be determined after an inquiry has been sent to the factory before a quotation can be generated.
- The option requires technical clarification and – depending on secondary technical conditions – may not be able to be realized for all types.

B00

NAMUR terminal strip

The terminal strip has been configured in accordance with the requirements and guidelines of the Standards Working Group for Instrumentation and Control in the Chemical Industry (NAMUR Recommendation NE37), i.e. fixed terminals are assigned to certain functions of the devices. The inputs and outputs assigned to the terminals comply with "Protective extra-low voltage PELV" requirements.

For temperature monitoring of explosion-protected motors, options for PTC thermistors with PTB approval and Pt100 evaluation units for use in hazardous areas are available.

This terminal strip and the associated functions are reduced to the required amount. Contrary to the NAMUR recommendation, no additional terminals are included.

Assignment of the NAMUR terminal strip

Terminal	No.	Type	Preassignment	Comment
For signal lines that must meet "Protective extra-low voltage PELV" requirements				
= LC–X2	1 1.0 1.1	M	Reference conductor to the 24 V DC infeed	–
	3 3.0 3.1	P24	24 V DC infeed	Protected internally with 2 A fuse
	10	DI	ON (dynamic)/ ON/OFF(static)	–
	11	DI	OFF (dynamic)	–
	12	DI	Faster	–
	13	DI	Slower	–
	14	DI	RESET	–
	15	DI	Interlock	Corresponds to OFF3
	16	DI	Counterclockwise	"0" signal for CW phase sequence "1" signal for CCW phase sequence
	17 18		PS disconnection	EMERGENCY STOP sequence
	30 31		Ready to run	Relay output (NO contact)
	32 33		Motor rotates	Relay output (NO contact)
	34	DO (NO)	Fault	Relay output (changeover contact)
	35	DO (COM)		
	36	DO (NC)		
	50 51	AI 0/4 ... 20 mA	Speed setpoint	–
	60 61	AO 0/4 ... 20 mA	Motor frequency	–
	62 63	AO 0/4 ... 20 mA	Motor current	Preassigned with motor current/can be reparameterized for other variables
For connecting the PTC sensor of the motor				
–A1–X3	90/91	AI	Connection of a PTC sensor	Shutdown if limit value is exceeded.

If Pt100 resistance thermometers are integrated into the windings of the motor in order to protect the motor, Pt100 evaluation units for explosion-protected motors are available with options **L95** and **L96**.

If a force-ventilated motor is used due to the application (load torque/control range), controlled outgoing feeders – protected using motor circuit breakers – are available with options **N30 to N33** to supply an external fan. The incoming voltage supply for the external fan must be provided on the plant side.

Options **N35 to N38** include a controlled and fused external voltage outgoing feeder for the anti-condensation heating in the motor.

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Options

B43 to B45

Production flowcharts:

Production flowcharts are provided with options **B43 to B45**. After the order has been clarified, these are sent as dual language (English/German) PDF file by E-Mail.

Option	Description
B43	Documentation, production flowchart: Generated once
B44	Documentation, production flowchart: Updated every two weeks
B45	Documentation, production flowchart: Updated every month

C30 to C49

Auxiliary voltage other than N/400 V/3 AC (SINAMICS GM150, SINAMICS SM150 in IGBT version)

A N/400 V/3 AC auxiliary supply must be provided on the plant side to supply power for the fans, open-loop/closed-loop control, protection and monitoring systems as well as the DC link pre-charging. If the auxiliary supply in the plant differs from this value, you must select one of the options **C30 to C49**. In this case the three-phase infeed supply which differs from the standard version is adapted with three individual transformers to the required voltage level. Tappings from 200 V 3 AC to 690 V 3 AC are available for this purpose. The current required for the auxiliary infeed supply can be determined from the data for the current requirement at 400 V 3 AC (see Technical Specifications, Conversion to Existing Auxiliary Voltage).

Order codes for auxiliary voltages and line frequencies	
C30	50 Hz 200 V 3 AC
C33	60 Hz 220 V 3 AC
C34	60 Hz 230 V 3 AC
C35	60 Hz 240 V 3 AC
C36	50 Hz 380 V 3 AC
C37	60 Hz 380 V 3 AC
C38	50 Hz 400 V 3 AC
C39	50 Hz 415 V 3 AC
C40	60 Hz 440 V 3 AC
C41	60 Hz 460 V 3 AC
C42	60 Hz 480 V 3 AC
C43	50 Hz 500 V 3 AC
C44	50 Hz 550 V 3 AC
C46	60 Hz 575 V 3 AC
C48	50 Hz 690 V 3 AC
C49	60 Hz 690 V 3 AC

Note:

A matching transformer is necessary if 50 Hz 400 V 3 AC is available on the plant side, however, without a neutral conductor connection. In this case, option **C38** should be selected. Exception: A separate 230 V supply can be provided for the closed-loop control on the plant side.

Note:

For isolated systems the maximum supply voltage is 500 V 3 AC.

Note:

Access to the matching transformers is possible only from the rear of the converter.

Auxiliary voltage infeed		Supply voltage for
= EA–Q11:1	L1	Fan, DC link precharging
= EA–Q11:3	L2	
= EA–Q11:5	L3	
= EB–X1:1	L1	Open-loop and closed-loop control, protection and monitoring equipment
= EB–X1:2	N	

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Options

C55

Auxiliary voltage 120 V 1 AC for open-loop and closed-loop control (SINAMICS GM150, SINAMICS SM150 in IGBT version)

The open-loop control of the converter can be supplied with 120 V 1 AC with option **C55** .

Note:

The following options are available in conjunction with option **C55** on special request:

- **L48** and **L49** (grounding switch at converter input and output)
- **L51** (disconnector at converter output)
- **L52** (circuit breaker at converter output)
- **N13** (circuit breaker at converter input)

D00 to D84

Documentation

The standard documentation is supplied in English on CD-ROM. The circuit diagrams/terminal diagrams are only available in English/German. Supplementary documentation for the components installed in the converter, which the manufacturers of these components provide, is supplied on the CD-ROM in English/German. For technical reasons, it is not possible to restrict the scope of this supplementary documentation to just the options that the customer has ordered.

Option	Description
D00	**Documentation in German** Use the code **D00** to obtain the documentation in German on CD-ROM.
D02	**Circuit diagrams, terminal diagrams and dimension drawings in DXF format** Documents such as circuit diagrams, terminal diagrams, the arrangement diagram and the dimension drawing with the code **D02** are ordered in DXF format so that they can be processed in AutoCAD systems, for instance.
D15	**One set of printed documentation (multiple orders possible)** If documentation is also required on paper, this must be ordered using the code **D15**.
D55	**Documentation in Polish** With order code **D55** the documentation is supplied in Polish on CD-ROM.
D56	**Documentation in Russian** Use the code **D56** to obtain the documentation in Russian on CD-ROM.
D57	**Documentation in Japanese (on request)** With order code **D57** the documentation is supplied in Japanese on CD-ROM.
D72	**Documentation in Italian (on request)** Use the code **D72** to obtain the documentation in Italian on CD-ROM.
D76	**Documentation in English** If a documentation language other than English is selected using options **D00** or **D55 to D84**, then by specifying order code **D76** , an additional CD-ROM with documentation in English as second documentation language can be ordered. Note: When simultaneously selecting option **D15** (a set of printed documentation) the printed documentation is only supplied in the first documentation language.
D77	**Documentation in French** Use the code **D77** to obtain the documentation in French on CD-ROM.
D78	**Documentation in Spanish** Use the code **D78** to obtain the documentation in Spanish on CD-ROM.
D79	**Documentation in Portuguese (Brazil)** With order code **D79** the documentation is supplied in Portuguese on CD-ROM.
D84	**Documentation in Chinese** Use the code **D84** to obtain the documentation in Chinese on CD-ROM.

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Options

E00

Closed-loop control for separately-excited synchronous motors (static excitation unit is provided on the plant side)

When option **E00** is selected, the converter is supplied without static excitation unit. The static excitation unit should be provided on the plant side.

E01

Closed-loop control for separately excited synchronous motors with slipring excitation (for static excitation units, see Accessories, Chapter 7)

If the converter is to be used to control separately excited synchronous motors with slipring excitation, put the code **E01** in the order. For slipring excitation, the exciter cabinet must also be ordered. It has its own order number.

Note:

Converter and exciter cabinet must be ordered together.

Note:

For SINAMICS GM150, option **E01** on request.

E02

Closed-loop control for separately excited synchronous motors with brushless excitation (on request, for static excitation units, see Accessories, Chapter 7)

If the converter is to be used to control separately excited synchronous motors with brushless excitation, order code **E02** must be specified when ordering. For brushless excitation, the exciter cabinet must also be ordered. It has its own order number.

E03

Control for permanently-excited synchronous motors

If the converter is to be used to control permanently-excited synchronous motors, order code **E03** must be included in the order.

Note:

Option **E03** requires that option **L52** is simultaneously ordered (circuit breaker at converter output).

Note:

For SINAMICS SM150 in IGBT version and SINAMICS GM150, option **E03** on request.

E11 to E71

(SINAMICS GM150, water-cooled) Individual certification of the converter by the relevant certifying organizations, including the extensions described under option M66

Option	Description
E11	**Suitable for marine use with individual certificate from Germanische Lloyd (GL)** includes option **M66**
E21	**Suitable for marine use with individual certificate from Lloyds Register (LR)** includes option **M66**
E31	**Suitable for marine use with individual certificate from Bureau Veritas (BV)** includes option **M66**
E51	**Suitable for marine use with individual certificate from Det Norske Veritas (DNV)** includes option **M66**
E61	**Suitable for marine use with individual certificate from the American Bureau of Shipping (ABS)** includes option **M66**
E71	**Suitable for marine use with individual certificate from the Chinese Classification Society (CCS)** includes option **M66**

Note:

It is not possible to combine several individual certificates.

Note:

For SINAMICS GM150 in IGBT version, the combination with option **Y15** (sine-wave filter) on request.

E82

Increased frequency (converter for high-speed rotors, SINAMICS GM150 in IGBT version)

When operated above 66 Hz, the converter should be classified as a converter for high-speed rotors.

E86

Additional analog inputs (isolated)

With option **E86** an additional TM31 Terminal Module is available. Its analog inputs are isolated. Multirange transformers are used (setting range: 0 V to 10 V; 0 mA to 20 mA or 4 mA to 20 mA).

Note:

Option **E86** cannot be combined with options **G62** (second additional TM31 Terminal Module), as well as **L94** and **L96** (2 Pt100 evaluation units).

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Options

E87

Additional analog outputs (isolated)

With option **E87** an additional TM31 Terminal Module is available. Its analog outputs are isolated. Multirange transformers are used (setting range: 0 V to 10 V; 0 mA to 20 mA or 4 mA to 20 mA).

Note:

Option **E87** cannot be combined with option **G62** (second additional TM31 Terminal Module).

F03, F29, F73, F77, F79, F97

Converter acceptance inspections in presence of customer

Option	Description
F03	**Visual acceptance** The checks are carried out with the converter deenergized. The following is included in the scope of the acceptance tests: • Check of degree of protection • Check of equipment (components) • Check of equipment identifier • Check of clearance and creepage distances • Check of cables • Check of customer documentation • Submitting the acceptance report
F29	**Noise measurement under no-load conditions (SINAMICS GM150 and SINAMICS SM150 in an air-cooled IGBT version)** With option **F29**, the sound pressure level of the converter is measured under no load conditions with the continuously operating fans switched on.
F73	**Functional acceptance of converter with inductive load** [1] After the visual inspection with the converter off, the converter is connected to rated voltage. Rated current flows in an inductive load at an output frequency of 5 Hz (without connector motor) on the converter output side. The following is included in the scope of the acceptance tests: • Visual inspection as described for option **F03** • Check of power supply • Check of protective and monitoring devices (simulation) • The fan is checked (for water cooling: cooling circuit elements in the converter) • Precharging test • Functional test with inductive load at rated voltage and rated current • Submitting the acceptance report
F77	**Acceptance of the converter insulation test** [1] The following is included in the scope of the acceptance tests: • High-voltage test • Measurement of insulation resistance Option **F77** can only be ordered in connection with options **F73**.
F79	**Test of the interface between the converter and customer equipment (5 hours)** [1] The analog, digital and serial interfaces are tested according to their preassignment described in Chapter 8. For additional test requirements, option **F97** must be selected. Option **F79** can only be ordered in connection with option **F73**.

[1] As a result of the local situation and the dimensions of the converter, the acceptance is always performed using a basic unit comprising a Line Module and a Motor Module.

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Options

Option	Description
F97	**Customer-specific system acceptance tests (on request)** For a system acceptance test, transformer (if technically required), converter, cooling system (if technically required) and motor should be set up and commissioned. Converter, cooling system and transformer are mounted directly next to each other, but separately from the motor. Only already pre-tested components (together with a test certificate) are subject to a system test. The tests that can be performed in the System Test Center are listed in the following. For each system acceptance test, the actual test scope must first be coordinated with the Siemens contact person. Temperature-rise test Full load test run or partial load test run of the motor in converter operation until the temperature reaches its steady-state level. The operating point should be preferably selected where the highest temperature increases is expected (M_N, n_N). The resistance method is the basis for determining the temperature rise. During the temperature-rise test, in addition to the motor temperatures, the electrical operating parameters of the complete drive system are also continuously recorded. Load tests • Load points at four different operating points • The system efficiency is determined at the defined load points • Line-side harmonics analysis Additional tests • High-voltage insulation test: The converter and motor have already been tested as part of the routine tests performed during production. Re-testing the converter is time-consuming and is not recommended. It can only be performed as part of a test that is separately performed for options **F73/F77**. • Converter function test: The fault and alarm functions are checked using defined simulation routines (e.g. overtemperature trip, EMERGENCY-STOP, overcurrent, overspeed, undervoltage) • 120 % overspeed test • Noise measurement (motor fed from the converter without load) • Vibration measurement (motor fed from the converter without load) • Visual inspection (converter and motor and where relevant, transformer)

Note:

An acceptance test of static excitation units according to options **F03**, **F73** and **F77** is only possible together with the converter which must be ordered simultaneously.

In general, a high voltage test of the converter is already performed during the type test. When the test is repeated as part of option **F77**, the test voltage is reduced to 80 % (according to DIN EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)).

Excitation units are only accepted as part of option **F97** when this option is simultaneously selected for the converter and excitation unit and is generally performed at another location and at another time.

F28, F72, F76

Converter acceptance tests without the customer present

The acceptance scope of these options corresponds to that of options **F29, F73** or **F77**, however, without the customer being present.

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Options

G20 to G24 and G34

Access to other bus systems

In the standard version the SINAMICS GM150 and SINAMICS SM150 are equipped with a PROFIBUS interface (slave). Additional interface modules are optionally available.

Option	Description
For SINAMICS GM150 (on request)	
G20	CAN bus interface (CANopen)
G21	Modbus Plus interface
G22	Modbus RTU slave interface
G23	DeviceNet interface
G24	PROFINET interface (via CBE20)
For SINAMICS SM150in IGCT version (on request)	
G34	PROFINET interface (via CBE30)

The SINAMICS Communication Boards CBC10 or CBE20 (option **G24** for SINAMICS GM150) and CBE30 (option **G34** for SINAMICS SM150) are used to connect to the CANopen bus system (option **G20**) or to PROFINET.

The "Anybus-X-Gateway" from the HMS Industrial Networks company is used to connect to third-party Modbus Plus systems (option **G21**), Modbus RTU (option **G22**) and DeviceNet (option **G23**).

When one of the options **G21 to G23** is ordered, the Anybus-X-Gateway is installed when the equipment is delivered and is connected to the CU320 Control Unit via a PROFIBUS cable. The scope of supply includes a null modem cable to configure the Anybus-X-Gateway. The Anybus-X-Gateway is preconfigured to 20 bytes of I/O data. The data size can be changed via the configuration interface from a PG/PC (standard PC tool "Windows Hyper Terminal").

The "NetTool" supplied by HMS Industrial Networks must be used to configure the PROFIBUS. This is not included in the scope of supply.

Current information, documentation and tools for Anybus-X-Gateway are available at
http://www.anybus.de

G25, G35

TeleService connection TS Adapter II analog modem, ISDN modem (SINAMICS GM150 in the IGBT version)

Using the TeleService connection, personnel in the central service department can perform all operator functions and settings with the STARTER software and provide support when service is required.

An appropriate modem is required for the TeleService connection. This permits communications to be established between the PROFIBUS inside the drive unit and a telephone cable to a central service department. This modem, with PROFIBUS connection, is integrated in a SIMATIC TS Adapter II, which is available in an analog (option **G25**) and an ISDN version (option **G35**). Under certain circumstances, an appropriate extension cable is required to connect to the telephone line.

Further, a 24 V DC power supply is required locally for the TS Adapter.

Note:

You will find additional information on TeleService in the following Service&Support article on the Internet at
http://support.automation.siemens.com/WW/view/de/20301397

G30

PROFIBUS master (SINAMICS GM150 with static excitation unit, see Accessories, Chapter 7)

SINAMICS GM150 converters can communicate as standard only as PROFIBUS slaves. Therefore, in conjunction with a SINAMICS GM150 converter, a SIMATIC S7 controller with PROFIBUS master capability is used in the static excitation unit.

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Options

G61

Additional TM31 Terminal Module

One TM31 Terminal Module and two TM15 Terminal Modules for integrating warning and fault messages and drive signals and for communicating with a higher control level are already included in the standard version of the converter. If the number of signals to be monitored is not sufficient, the interface can also be extended by an additional Terminal Module. Additional digital inputs and outputs and two analog inputs and outputs are available with the TM31.

The TM31 Terminal Module has:

- 8 digital inputs
- 4 bidirectional digital inputs and outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor (KTY84-130 or PTC)

The following table shows an overview of the exclusions, which must be considered when selecting options **G61** or **G62**.

	G61	G62	E86	E87	L80 to L93, L95	L94, L96
G61		✓	✓	✓	–	–
G62	✓		–	–	✓	–
E86	✓	–		✓	✓	–
E87	✓	–	✓		✓	✓
L80 bis L93, L95	–	✓	✓	✓		✓
L94, L96	–	–	–	✓	✓	

✓ Options can be combined

– Options are mutually exclusive

Note:

For isolated analog inputs/outputs, options **E86** or **E87** are available.

TM31 Terminal Module	
Digital inputs	
• Voltage	-3 ... +30 V
• Low level (an open digital input is interpreted as "low")	-3 ... +5 V
• High level	15 ... 30 V
• Current consumption at 24 V DC, typ.	10 mA
• Signal propagation times of digital inputs, approx.	
- L → H	50 µs
- H → L	100 µs
• Conductor cross-section, max.	1.5 mm²
Digital outputs (sustained short-circuit strength)	
• Voltage	24 V DC
• Load current per digital output, max.	100 mA
• Total current of digital outputs, max.	400 mA
• Conductor cross-section, max.	1.5 mm²
Analog inputs (a switch is used to toggle between voltage and current input)	
• As voltage input	
- Voltage range	-10 ... +10 V
- Internal resistance R_i	100 kΩ
• As current input	
- Current range	4 ... 20 mA/-20 ... +20 mA, 0 ... 20 mA
- Internal resistance R_i	250 Ω
- Resolution	11 bit + sign
• Conductor cross-section, max.	1.5 mm²
Analog outputs (sustained short-circuit strength)	
• Voltage range	-10 ... +10 V
• Load current, max.	-3 ... +3 mA
• Current range	4 ... 20 mA, -20 ... +20 mA, 0 ... 20 mA
• Load resistance, max.	500 Ω for outputs in the range -20 ... +20 mA
• Resolution	11 bit + sign
• Conductor cross-section, max.	1.5 mm²
Relay outputs (changeover contacts)	
• Load current, max.	8 A
• Operating voltage, max.	250 V AC, 30 V DC
• Switching power at 250 V AC, max.	2000 VA (cos φ = 1) 750 VA (cos φ = 0.4)
• Switching power at 30 V DC, max.	240 W (ohmic load)
• Required minimum current	100 mA
• Conductor cross-section, max.	2.5 mm²

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Options

Terminal connection overview for IGBT version

Terminal strip at TM31 (=.HD–A11)

Terminal	Type		Preassignment	Comment
X520:				
1-8	P24	24 V DC supply for inputs DI0 to DI7	–	–
X520:				
1	DI0	Digital input electrically isolated via optocoupler	–	Pre-assigned for options L91, L93 and L96
2	DI1		–	
3	DI2		–	Pre-assigned for options L93 and L95
4	DI3		–	
5	M1	Reference ground for digital inputs DI0 to DI3	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X530:				
1	DI4	Digital input electrically isolated via optocoupler	–	Pre-assigned for options L90 and L91
2	DI5		–	
3	DI6		–	Pre-assigned for options L80 to L82
4	DI7		–	
5	M2	Reference ground for digital inputs DI4 to DI7	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X541:				
1	P24	24 V DC supply for inputs/outputs DI/O8 to DI/DO11	–	–
2	DI/DO8	Digital inputs/ digital outputs non-isolated	–	Pre-assigned for options L81 and L82
3	DI/DO9		–	
4	DI/DO10		–	Pre-assigned for option L82
5	DI/DO11		–	
6	M	Reference ground for P24, ground of digital inputs/ digital outputs	–	–

Terminal strip at TM31 (=.HD–A11)

Terminal	Type		Preassignment	Comment
X521:				
1	AI0+	Analog inputs set up as differential inputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA The voltage input/current input is selected with a switch	–	–
2	AI0-			
3	AI1+		–	–
4	AI1-			
5	P10	Auxiliary voltage ± 10 V (10 mA) to connect a potentiometer to enter a setpoint via an analog input	–	–
6	M		–	–
7	N10		–	–
8	M		–	–
X522:				
1	AO 0V+	Analog outputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA	–	–
2	AO 0V-			Pre-assigned for options L93 and L95
3	AO0C+			–
4	AO 1V+		–	–
5	AO 1V-			Pre-assigned for options L93 and L95
6	AO 1C+			–
7	KTY+	Temperature sensor KTY84 0 ... 200 °C or PTC (R_{cold} < 1.5 kΩ)	–	The sensor type must be parameterized
8	KTY-		–	
X542:				
1	DO 0.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
2	DO 0.COM		–	Basic
3	DO 0.NO		–	NO contact
4	DO 1.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
5	DO 1.COM		–	Basic
6	DO 1.NO		–	NO contact

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Options

Terminal connection overview for IGCT version

Terminal strip at TM31 (=.HD–A11)

Terminal	Type		Preassignment	Comment
X540:				
1-8	P24	24 V DC supply for inputs DI0 to DI7	–	–
X520:				
1	DI0	Digital input electrically isolated via optocoupler	–	Pre-assigned for options L91 to L96
2	DI1		–	
3	DI2		–	Pre-assigned for options L92 to L96
4	DI3		–	
5	M1	Reference ground for digital inputs DI0 to DI3	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X530:				
1	DI4	Digital input electrically isolated via optocoupler	–	Pre-assigned for options L90 to L92
2	DI5		–	
3	DI6		–	Pre-assigned for options L80 to L82
4	DI7		–	
5	M2	Reference ground for digital inputs DI4 to DI7	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X541:				
1	P24	24 V DC supply for inputs/outputs DI/O8 to DI/DO11	–	–
2	DI/DO8	Digital inputs/ digital outputs non-isolated	–	Pre-assigned for options L81 and L82
3	DI/DO9		–	
4	DI/DO10		–	Pre-assigned for option L82
5	DI/DO11		–	
6	M	Reference ground for P24, ground of digital inputs/ digital outputs	–	–

Terminal strip at TM31 (=.HD–A11)

Terminal	Type		Preassignment	Comment
X521:				
1	AI0+	Analog inputs set up as differential inputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA The voltage input/ current input is selected with a switch	–	–
2	AI0-			
3	AI1+		–	–
4	AI1-			
5	P10	Auxiliary voltage ± 10 V (10 mA) to connect a potentiometer to enter a setpoint via an analog input	–	–
6	M		–	–
7	N10		–	–
8	M		–	–
X522:				
1	AO 0V+	Analog outputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA	–	–
2	AO 0V-			Pre-assigned for options L93 to L96
3	AO0C+			–
4	AO 1V+		–	–
5	AO 1V-			Pre-assigned for options L93 to L96
6	AO 1C+			–
7	KTY+	Temperature sensor KTY84 0 ... 200 °C or PTC (R_{cold} < 1.5 kΩ)	–	The sensor type must be parameterized
8	KTY-		–	
X542:				
1	DO 0.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
2	DO 0.COM		–	Basic
3	DO 0.NO		–	NO contact
4	DO 1.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
5	DO 1.COM		–	Basic
6	DO 1.NO		–	NO contact

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Options

G62

Second additional TM31 Terminal Module

With order code **G62** a second TM31 Terminal Module can be ordered (description and exclusions under option **G61**).

Terminal connection overview

Terminal strip at TM31 (=.HD–A31)

Terminal	Type		Preassignment	Comment
X520:				
1-8	P24	24 V DC supply for inputs DI0 to DI7	–	–
X520:				
1	DI0	Digital input electrically isolated via optocoupler	–	Pre-assigned for options L94 and L96
2	DI1		–	
3	DI2		–	
4	DI3		–	
5	M1	Reference ground for digital inputs DI0 to DI3	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X530:				
1	DI4	Digital input electrically isolated via optocoupler	–	–
2	DI5		–	
3	DI6		–	–
4	DI7		–	
5	M2	Reference ground for digital inputs DI4 to DI7	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X541:				
1	P24	24 V DC supply for inputs/outputs DI/O8 to DI/DO11	–	–
2	DI/DO8	Digital inputs/ digital outputs non-isolated	–	–
3	DI/DO9		–	
4	DI/DO10		–	–
5	DI/DO11		–	
6	M	Reference ground for P24, ground of digital inputs/ digital outputs	–	–

Terminal strip at TM31 (=.HD–A31)

Terminal	Type		Preassignment	Comment
X521:				
1	AI0+	Analog inputs set up as differential inputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA The voltage input/ current input is selected with a switch	–	–
2	AI0-			
3	AI1+		–	–
4	AI1-			
5	P10	Auxiliary voltage ± 10 V (10 mA) to connect a potentiometer to enter a setpoint via an analog input	–	–
6	M		–	–
7	N10		–	–
8	M		–	–
X522:				
1	AO 0V+	Analog outputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA	–	–
2	AO 0V-			Pre-assigned for options L94 and L96
3	AO0C+			–
4	AO 1V+		–	–
5	AO 1V-			Pre-assigned for options L94 and L96
6	AO 1C+			–
7	KTY+	Temperature sensor KTY84 0 ... 200 °C or PTC (R_{cold} < 1.5 kΩ)	–	The sensor type must be parameterized
8	KTY-		–	
X542:				
1	DO 0.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
2	DO 0.COM		–	Basic
3	DO 0.NO		–	NO contact
4	DO 1.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
5	DO 1.COM		–	Basic
6	DO 1.NO		–	NO contact

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Options

G63

Additional TM15 Terminal Module

One TM31 Terminal Module and two TM15 Terminal Modules for integrating alarm and fault messages as well as control signals and for communicating with a higher-level control are already included in the standard version of the converter. The number of digital inputs and outputs can be expanded with an additional TM15 Terminal Module. This is recommended if, for instance, external signals are to be read in and processed or external components are to be controlled in addition to the standard customer's terminal strip.

The TM15 Terminal Module has:

- 24 bidirectional digital inputs and outputs (isolation in three groups of eight channels each)
- 24 green status LEDs for indicating the logical signal status of the relevant terminal

TM15 Terminal Module	
Digital inputs	
• Voltage	-30 ... +30 V
• Low level (an open digital input is interpreted as "low")	-30 ... +5 V
• High level	15 ... 30 V
• Current consumption at 24 V DC	5 ... 11 mA
• Signal propagation times of digital inputs, typ.	
- L → H	50 µs
- H → L	100 µs
• Conductor cross-section, max.	1.5 mm²
Digital outputs (sustained short-circuit strength)	
• Voltage	24 V DC
• Load current per digital output, max.	0.5 A
• Output delay (ohmic load)	
- L → H, typ./max.	50/100 µs
- H → L, typ./max.	150/225 µs
• Total current of digital outputs (per group)	400 mA
- Up to 60 °C	2 A
- Up to 50 °C	3 A
- Up to 40 °C	4 A
• Conductor cross-section, max.	1.5 mm²

G66

PADU8 diagnostics module (SINAMICS GM150 in IGCT version and SINAMICS SM150 in IGCT version)

The PADU8 diagnostic module reads out up to eight analog signals and up to eight digital signals from the gating and monitoring module of the power unit and makes these available for diagnostic purposes or for further processing. The typical detection cycle of all channels in parallel is 1 ms, enabling rapid signal characteristics to be detected and diagnosed simultaneously. The detected values are transferred to an evaluation system (e.g. notebook) either by optical conductors or by an RJ11 socket. All output data are available in parallel at the optical conductor output and at the RJ11 socket. This means that measurements can be taken in parallel at the RJ11 socket without disrupting the transfer of data at the optical conductor. With the option **G66** a PADU8 diagnostic module is integrated in the control section of each Motor Module.

G70

Pulse distributor for transferring the speed encoder signal (SINAMICS SM150; SINAMICS GM150 on request)

With this pulse distributor it is possible to split the encoder signal. This possibility is used, for example, when speed list values from an HTL incremental encoder are required at various points for measured-value acquisition and processing.

The pulse distributor transfers the HTL incremental encoder signals to two separate RS422 signal outputs. The inputs are electrically isolated from the outputs.

8-pole terminal strips are used for the connection.

Note:

For SINAMICS GM150, option **K50** (Sensor Module Cabinet-Mounted SMC30) should be ordered at the same time.

G71

Optical bus terminal (OBT) for PROFIBUS (SINAMICS SM150; SINAMICS GM150 on request)

PROFIBUS OBT is a network component for use in optical PROFIBUS DP fieldbus networks. The individual bus stations are linked using two-phase plastic optical conductors. These automatically provide isolation and prevent potential differences in large plants from having any impact.

The OBT has three interfaces:
Channel 1 is an electrical RS485 interface which is implemented as a 9-pole Sub D socket connector and establishes the link to the converter control.
Channels 2 and 3 form the optical interface. They are configured as a duplex socket and can be used for connection on the plant side to higher-level systems.

Note:

For SINAMICS GM150, option **G71** cannot be combined with options **G20 to G24** and **G34** (access to other bus systems) as well as with **G25** and **G35** (Teleservice).

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Options

K20

Indicator lights in the cabinet door

With option **K20**, five indicator lights that signal the operating status of the converter are provided in the cabinet door of the control section.

- Fault (red)
- Warning (yellow)
- Operation (green)
- Drive ready (white)
- Local operation (white)

K21

Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights

To enable process variables to be displayed, analog display instruments that show the measurement parameter as a % are located in the cabinet door.

- Motor current (0 to +120 %)
- Motor speed (-120 % ... 0 ... +120 %)
- Calculated motor power (0 to +120 %)
- Motor voltage (0 to +120 %).

Note:

Option **K21** includes option **K20**.

K22

Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights

To enable process variables to be displayed, analog display instruments that show the measurement parameter as a % are installed in the cabinet door. The motor winding temperature is displayed as an absolute value in °C.

- Motor current (0 to +120 %)
- Motor speed (-120 % ... 0 ... +120 %)
- Calculated motor power (0 to +120 %)
- Motor winding temperature (0 to 200 °C)

Note:

Option **K22** includes option **K20**.

K50

SMC30 Sensor Module Cabinet-Mounted (SINAMICS GM150, standard for SINAMICS SM150)

The SMC30 encoder module can be used to record the actual motor speed. The signals from the rotary pulse encoder are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.

The following encoders are supported by the SMC30:

- TTL encoders
- HTL encoders

The maximum connectable conductor cross-section is 20 mm^2.

Terminal	Significance
X521:	
1	Track A+
2	Track A-
3	Track B+
4	Track B-
5	Track R+
6	Track R-
X524:	
1	Power supply 5 V/24 V
2	

K80

Control of "Safe Torque Off" function (SINAMICS SM150; SINAMICS GM150 on request)

The "Safe Torque Off" function is a "mechanism for preventing the drive from unexpectedly starting" according to EN 60204-1/ VDE0113T1 (IEC 60204-1), Section 5.4. In conjunction with external circuitry, the "Safe Torque Off" function has been certified by TÜV-Süd [German Technical Inspectorate] in accordance with EN ISO 13849-1 with Safety Category 3 and Performance Level d as well as EN 61508 (IEC 61508), Parts 1 to 4, SIL 2. However, this certification is only valid if the plant-side circuit breaker is equipped with an undervoltage trip unit.

The switch on the motor side as shutdown path can be eliminated as a result of the "Safe Torque Off" function.

The comparison between options **K80** and **L60** contains additional information. (see the description of option **L60**).

Note:

Option **K80** is only available for SINAMICS GM150 on request. However, option **L60** (EMERGENCY-STOP, Stop Category 1 for controlled stopping) is available for this purpose.

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Options

L08

Output reactor

The output reactor is used to limit the capacitive charge-reversal currents of motor cables. Data regarding cable lengths when using the output reactor can be obtained for specific systems from your local Siemens sales contact.

Converter	**Max. cable lengths**			
	Without output reactor (standard)		With output reactor [1] (option **L08**)	
	Shielded	Un-shielded	Shielded	Un-shielded
Output voltage 2.3 kV to 4.16 kV				
SINAMICS GM150 IGBT version and SINAMICS SM150 IGBT version	Up to 2 parallel cables: each 100 m	Not permitted	On request	Not permitted
	3 parallel cables: each 80 m			
	>3 parallel cables: not permitted			
Output voltage 3.3 kV				
SINAMICS GM150 as IGCT version	Up to 2 parallel cables: each 100 m	Not permitted	On request	Not permitted
	3 parallel cables: each 80 m			
	4 parallel cables: each 80 m			
	Mechanically, up to six parallel cables are possible (on request).			
SINAMICS SM150 IGCT version	Up to 4 parallel cables: each 80 m	Not permitted	On request	Not permitted
	Mechanically, up to six parallel cables are possible (on request).			

The output reactor is located in an additional cabinet unit.

Notice:

When using an output reactor, the following values apply for the maximum output frequency:

- SINAMICS GM150 in IGBT version and SINAMICS SM150 in IGBT version: 150 Hz
- SINAMICS GM150 in IGCT version and SINAMICS SM150 in IGCT version: 90 Hz

Notice:

With option **L08** the cabinet width is increased as follows:

- SINAMICS GM150 in IGBT version and SINAMICS SM150 in IGBT version:
  - Single circuit configuration: 600 mm
  - Parallel circuit configuration: 2 × 600 mm

When option **M13** or **M78** is simultaneously selected the width does not have to be increased.

- SINAMICS GM150 in IGCT version and SINAMICS SM150 in IGCT version: 700 mm per converter unit

When option **L49** or **L51/L52** is simultaneously selected, the width does not have to be increased.

[1] Distance between the converter and the motor depending on the current load for max. 6 three-wire EMC cables connected in parallel.

L21

Overvoltage protection AC (static excitation unit, see Accessories, Chapter 7)

Option **L21** provides type SICROWBAR integrated overvoltage protection on the input side.

L29

Bidirectional synchronized bypass operation (SINAMICS GM150 in the IGBT version with induction motor)

Option **L29** offers synchronization with seamless (commutating) passing of the motor to the line and receiving of the motor from the line.

The converter synchronizes the motor to the existing line (phase relation, frequency and voltage). The motor is subsequently connected in parallel to the line by means of circuit breaker S3 before the output-side circuit breaker S2 opens.

Approx. 100 ms go by according to the response time constants of the two circuit breakers (opening time and closing time). Within this period of time the motor commutates from the converter to the line. This ensures smooth passing of the motor to the line.

If the motor is to be subsequently taken from the line and operated using the converter again, the commutation process is executed in the reverse order. The converter is first run up no-load operation and its output voltage is adapted to the line voltage (= motor voltage) in its phase relation, frequency and amplitude. Then circuit breaker S2 is closed before S3 is opened and the motor is isolated from the line.

This ensures that the motor is received smoothly by the converter so that it can be either operated under variable speed or shut down under control. Speed-controlled operation during running up and shutting down does not produce any high starting and peak transient torques that could damage the mechanical connection or cause transient and pressure fluctuations in the process.

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Options

With option **L29** a VSM10 Voltage Sensing Module is integrated into the converter. The VSM10 detects the line supply voltage regarding phase position, frequency and amplitude. A voltage transformer, which should be provided on the primary side of the switch S1 (plant-side) is used for this purpose. It thus supplies the data for synchronization of the motor to the line and from the line to the converter. The converter control prepares the drive signals of the two circuit breakers to be provided on the plant side.

In addition, an output reactor with u_K = 10 % (±2 %) or option **Y15** (sine-wave filter) is required to decouple the converter during commutation.

Note:

A u_K value of 10 % cannot be reached with option **L08** (output reactor).

Circuit breaker S3 should be dimensioned so that it protects the motor against overvoltage and overcurrent during line supply operation. If temperature sensors are fitted in the motor, these must be monitored on the plant side for the case of mains operation.

Notice:

Option **L29** is only possible if the converter output voltage is the same as the line voltage.

L32

Automatic restart (SINAMICS GM150)

Option **L32** enables the converter to be restarted after a power failure once the mains supply has been restored.

If such a restart is required for technical reasons, the conditions set out below must be taken into consideration.

The 400 V 3 AC and 230 V 1 AC auxiliary infeed supplies must not fail; this is so that the voltage supply to the fans and coolant pumps and to the controller and closed-loop control is maintained.

If the main infeed fails, a pulse block is triggered and the DC link is supported through precharging for a short period. It is important to distinguish between two cases here:

Case A:

The circuit breaker on the input side is still switched on.

When the medium voltage supply returns, the DC link voltage rises. This is detected by the closed-loop control and the controller. Operation is resumed when a threshold value is exceeded.

Case B:

The circuit breaker on the input side has responded.

After a fixed time (which can be parameterized), the circuit breaker receives an "ON command". The response of the DC link voltage is then analyzed.

If the DC link voltage falls, the converter is disconnected.

If the DC link voltage rises, operation is resumed when a threshold value is exceeded.

Depending on the down times, load characteristic and moment of inertia, the drive may be "caught" again or the machine may need to be "excited" again first before operation can be resumed.

With option **L32** a VSM10 Voltage Sensing Module is integrated into the converter. The VSM10 detects the line supply voltage regarding phase position, frequency and amplitude. A voltage transformer, which should be provided on the primary side of the switch S1 (plant-side) is used for this purpose. This enables the controller and closed-loop control to detect when the medium voltage returns after a power failure if the circuit breaker on the input side has dropped out.

For safety reasons, a time limit is built in between the power failure and the maximum permitted line restoration time so that the drive cannot start up again uncontrolled.

A signal is issued in addition when restarting and can be used to generate an acoustic warning.

Note:

For SINAMICS SM150 in the IGBT and IGCT versions, the Voltage Sensing Module VSM10 as well as the software functionality is included as standard.

Connections at the VSM10 Voltage Sensing Module

DRIVE-CLiQ interface to connect VSM10

Pin	Signal name	Comment
X500:		
1	TXP	Transmit data +
2	TXN	Transmit data -
3	RXP	Receive data +
4	Reserved	–
5	Reserved	–
6	RXN	Receive data -
7	Reserved	–
8	Reserved	–
A	+ (24 V)	Power supply
B	M (0 V)	Electronic ground

Electronics power supply VSM10

Terminal	Type	Comment
X524:		
+	Electronics power supply	Voltage: 24 V DC (20.4 ... 28.8 V)
+	Reserved	Current consumption: Max. 0.2 A
M	Electronic ground	
M	Electronic ground	Max. current via the jumper in the connector: 20 A at 55 °C

Analog inputs/temperature sensor input VSM10

Terminal	Type	Comment
X520:		
1	AI 0+	Inputs can be parameterized via the software, resolution: 12 bit
2	AI 0-	
3	AI 1+	
4	AI 1-	
5	+Temp	Temperature sensor connection KTY84-1C130/PTC
6	-Temp	

Phase inputs VSM10

Terminal	Type	Comment
X522:		
1	Phase voltage U	Phase differential voltages U_{UV} and U_{VW} are sensed.
2	Phase voltage V	
3	Phase voltage W	

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Options

L48

Make-proof grounding switch at the converter input, motor-operated (SINAMICS SM150 in IGBT version on request only)

If grounding on the infeed side is required for safety and protection reasons, a motorized make-proof grounding switch can be ordered under code **L48**. The number of make-proof grounding switches depends on the particular infeed version (12/24-pulse for SINAMICS GM150 or 6-pulse for SINAMICS SM150).

For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.

In the event of maintenance work on the converter, it must be ensured on the plant side that there is no external voltage present, e.g. auxiliary voltage for fans, the cooling system, controller and closed-loop control and any external outputs in the converter.

Notice:

With option **L48** the cabinet width is increased as follows:

- SINAMICS GM150 in IGBT version:
  600 mm
- SINAMICS GM150 in IGCT version:
  2 × 700 mm per converter unit
- SINAMICS SM150 in IGCT version:
  700 mm per converter unit

Note:

Option **L48** in conjunction with option **C55** (auxiliary power supply for open-loop and closed-loop control) on request.

Note:

For SINAMICS GM150 in IGCT version, option **L48** in conjunction with option **N15** (24-pulse Basic Line Module) on request.

L49

Make-proof grounding switch at the converter output, motor-operated (SINAMICS SM150 in IGBT version on request only)

In certain operating modes/versions of the load machine (e.g. drive line-up with gas turbines) and types of drive motor (e.g. PEM), operating statuses may occur in which there is a risk that energy is fed back to the converter by the motor This can lead to dangerous voltages. In these cases a motorized grounding switch for the converter output side can be ordered under code **L49**. Where power units are connected in parallel, the number of circuit breakers will rise accordingly.

For safety reasons, the converter open-loop control locks the grounding switch against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.

Notice:

With option **L49** the cabinet width is increased as follows:

- SINAMICS GM150 in IGBT version:
  600 mm

When options **L51** or **L52** are simultaneously selected, the width does not have to be increased.

- SINAMICS GM150 in IGCT version and
  SINAMICS SM150 in IGCT version:
  700 mm per converter unit

When options **L08** and/or **L51/L52** are simultaneously selected, the width does not have to be increased.

Note:

Option **L49** in conjunction with option **C55** (auxiliary power supply for open-loop and closed-loop control) on request.

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Options

L50

Cabinet lighting and service socket in the closed-loop control section

If option **L50** is chosen, a universal lamp and a service socket (Schuko version) are installed respectively in the cabinet panels of the control sections for Motor Modules and Active Line Modules.

The power supply for the cabinet lighting and service socket (on terminal strip = EG-X1) is provided externally. The cabinet lighting is switched on manually via a switch or automatically by an integrated motion detector. The mode is switch-selected.

Terminal	Significance
= EG-X1:1	L1 (230 V)
= EG-X1:2	N

L51

Disconnector at the converter output

If isolation between the converter output and the drive motor is required for safety and protection reasons, a motorized isolator at the converter output can be ordered under code **L51**.

Notice:

The cabinet width increases as follows due to the additional cabinet at the converter:

- SINAMICS GM150 in IGBT version and
  SINAMICS SM150 in IGBT version:
  600 mm

When option **L49** is simultaneously selected, the width does not have to be increased.

- SINAMICS GM150 in IGCT version and
  SINAMICS SM150 in IGCT version:
  700 mm per converter unit

When option **L08** or **L49** are simultaneously selected, the width does not have to be increased.

Note:

Option **L51** cannot be combined with option **L52** (circuit breaker at the converter output), and can be ordered on request in conjunction with option **C55** (auxiliary power supply for open-loop and closed-loop control).

L52

Circuit breaker at converter output

If isolation between the converter output and the drive motor is required for safety and protection reasons, a circuit breaker at the converter output can be ordered under code **L52**. This circuit breaker is triggered from the converter controller. On an ON command, the circuit breaker on the output side is connected together with the auxiliaries. The circuit breaker is switched off with the OFF command.

Note:

Option **L52** is mandatory in conjunction with permanent-magnet synchronous motors. However, a separate inquiry is required for this option, as several variable secondary conditions must be taken into account.

Note:

Option **L52** cannot be combined with option **L51** (disconnector at the converter output), and can be ordered on request in conjunction with option **C55** (auxiliary power supply for open-loop and closed-loop control).

Notice:

With option **L52** the cabinet width is increased as follows:

- SINAMICS GM150 in IGBT version and
  SINAMICS SM150 in IGBT version:
  600 mm

When option **L49** is simultaneously selected, the width does not have to be increased.

- SINAMICS GM150 in IGCT version and
  SINAMICS SM150 in IGCT version:
  700 mm per converter unit

When option **L08** or **L49** are simultaneously selected, the width does not have to be increased.

L53

UPS for the power supply of the open-loop and closed-loop control (SINAMICS GM150 on request)

If there is a danger of voltage dips and brief line supply failures in the plant, then the drive can continue to operate if the closed-loop control is supplied from a UPS. The prerequisite for continued operation is that the DC link voltage does not fall below the $V_{d\,min}$ limit and the medium-voltage switch does not trip due to an undervoltage condition. This means that the drive can tolerate voltage dips up to brief line supply failures; this is especially true if the driven load has a high moment of inertia and the DC link can be kinetically buffered.

In the case of line supply interruptions that cause the power unit to shut down, the downtime is reduced using the automatic restart function (option **L32**). The UPS is configured for a buffer time of up to 10 min.

Note:

Option **L53** limits the temperature range as follows:
continuous operation: 0 to +40 °C
operation <2 h/d: 0 to +45 °C
transport and storage: -15 to +50 °C

Terminal	Significance
= EB-X1:1	L1 (230 V)
= EB-X1:2	N

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Options

L55

Anti-condensation heating for the cabinet

The anti-condensation heating is recommended at low ambient temperatures and high levels of humidity to prevent condensation. The number of 100 W switch cabinet unit heaters fitted depends on the number of cabinet panels. The anti-condensation heaters are controlled by means of a thermostat. Should the external auxiliary infeed fail, this is monitored and reported by the converter for safety reasons.

The voltage for the anti-condensation heating (110 V to 240 V AC, on terminal block = GB–X1:) must be supplied externally.

Terminal	Significance
= GB–X1:1A	L1 (110 ... 240 V)
= GB–X1:2A	N

L60

EMERGENCY STOP, Stop Category 1 for controlled stopping (SINAMICS GM150)

For uncontrolled stopping, the standard converter is equipped with an EMERGENCY-OFF function, which involves integrating an external safety circuit and a positively opening mushroom pushbutton at the front of the unit. When the mushroom pushbutton is pressed, the line supply voltage is disconnected from the converter through the circuit breaker and the motor then coasts down.

As a supplement, the "EMERGENCY-STOP, Stop Category 1" function is available (acc. to EN 60204-1/VDE 0113 T1 (IEC 60204-1)) with option **L60**. This includes stopping the drive in an open-loop controlled fashion using a fast stop along a down ramp that has to be parameterized by the user. The line supply is then disconnected from the converter – the same as for EMERGENCY-OFF – via the time-delayed contact of the safety relay being used. The duration should be set at the safety relay corresponding to the selected down ramp. The selection and the feedback signal of the "EMERGENCY-STOP, Stop Category 1" function are connected to the customer's terminal strip.

Among others, depending on the safety relay selected (single-channel or two-channel) and the selected fault detection (e.g. using cyclic tests) a maximum of Safety Category 3 according to EN 954-1:1996 or EN ISO 13849-1:2006 can be achieved for the "EMERGENCY-STOP, Stop Category 1" function.

Notice:

The braking process can take considerable time even with an EMERGENCY-STOP, Stop Category 1.

Among other things, this depends on the total moment of inertia of the drive train. It may be necessary to use a Braking Module (option **L72**).

In addition to option **L60**, the "Safe Torque Off (STO)" safety function is available as option **K80** on request. The two options are compared in the following table.

	Option **L60** EMERGENCY-STOP, Stop Category 1 for controlled stopping	Option **K80** Safe Torque Off (STO)
Functionality	When activated, the drive is braked down to zero speed and the energy feed to the converter is then interrupted by opening the circuit breaker. In addition to the software intervention (OFF3), a safety relay also ensures that the circuit breaker reliably opens.	When activated, the drive is braked down to zero speed and then the gating commands of the power semiconductors are safely inhibited. The circuit breaker remains closed so that the converter is still connected to the power supply. The option also fulfills the "EMERGENCY-STOP, Stop Category 1" function as the rotating motor is brought to a standstill by removing the drive energy.
Assured safety feature	The converter is disconnected from the power after the selected delay time of the safety relay has expired	Driving torque is safely switched off according to safety category
Safety category	Up to category 3 acc. to EN 9541:1996 or EN ISO 138491:2006 can be achieved, depending on the circuit arrangement of the safety relay and the fault detection using separate tests.	EN 9411: 1996, Category 3 IEC 61508: 2000, Parts 1 to 4, SIL2
Certification of the option	No; however, the German Statutory Industrial Accident Insurance Association has certified the safety relay	Yes; by TÜV Süd [German Technical Inspectorate]
User's view	**The user is responsible for configuring and implementing the safety function.**	**The complete safety function is certified if the specifications are strictly met.**
Availability	SINAMICS GM150	SINAMICS SM150, SINAMICS GM150 on request

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Options

L72

Braking Module

In order to permit braking operation for Basic Infeed (SINAMICS GM150) or for Active Infeed (SINAMICS SM150) to be able to brake even if the power fails, a Braking Module with braking resistor can be used. The mechanical design of the Braking Module corresponds to that of a Motor Module; its actual version is adapted to the converter cooling type (air or water cooling).

The following should be ensured when engineering:

- Shielded cables should be used just the same as at the converter output.
- The same maximum cable lengths as for SINAMICS GM150 in the IGBT version apply (without sine-wave filter or output reactor; refer to Power cables, Page 9/13).
- Regarding inductance *L*, the following requirements apply to the braking resistor and cable routing: The time constant *L/R* must not exceed 20 µs, i.e. *L* must be less than $R \times 20$ µs.

Note:

An external load resistor is connected as the braking resistor. This is not included in the scope of supply (option **Y73** see Page 6/42).

Note:

Option **L72** cannot be combined with option **M61** (redundant fan in the power unit).

Note:

For SINAMICS SM150 in IGCT version, option **L72** on request.

Note:

For SINAMICS GM150 in IGCT version, option **L72** cannot be combined with option **N15** (24-pulse Basic Line Module).

Notice:

With option **L72** the cabinet width is increased as follows:

- SINAMICS GM150 in the 12-pulse IGBT version: 600 mm
- SINAMICS SM150 in the IGCT version: 1800 mm

Braking power of the Braking Module with external braking resistor

Converter output voltage	Cooling method	Required braking resistor (± 10 %)	Braking resistor supply voltage	Braking power Braking Module	
				P_{20}	P_{DB}
kV		Ω	kV	kW	kW
SINAMICS GM150 in IGBT version					
2.3	Air	9.5	4.1	1000	333
	Water	7.5	4.1	1250	417
3.3	Air	13.5	5.8	1400	467
	Water	11	5.8	1700	567
4.16	Air	17.5	7.5	1800	600
	Water	14	7.5	2250	750
SINAMICS GM150 in IGCT version and SINAMICS SM150 in IGCT version					
3.3	Water	2 × 2.2	5.8	4000 [1]	4000

Note:

The data in the table above apply for the maximum control of the Braking Module. Different values for braking resistors are available on request.

Power connections, braking resistor

Terminal	Significance
SINAMICS GM150 and SINAMICS SM150 in IGBT version	
1C1	Power cable connection (+)
1D1	Power cable connection (–)
SINAMICS GM150 and SINAMICS SM150 in IGCT version	
1C1	Power cable connection (+)
1D1	Power cable connection (–)
1M1	Power cable connection (0)

Connections, temperature monitoring for braking resistor

Terminal	Significance
SINAMICS GM150 and SINAMICS SM150 in IGBT version	
=.CG-X11:1	24 V DC power supply
=.CG-X11:2	Braking resistor temperature too high, fault
=.CG-X11:3	Braking resistor temperature too high, alarm
=.CG-X11:5	Air flow switch ON (option **Y73**)
=.EF-X22:8	Reference ground
SINAMICS GM150 and SINAMICS SM150 in IGCT version	
=.CG-X11:1	24 V DC power supply
=.CG-X11:2	Braking resistor temperature too high, fault
=.CG-X11:3	Braking resistor temperature too high, alarm
=.EF-X22:4	Reference ground

[1] Values can be higher for brief periods (in the range of seconds).

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Options

Block diagram of the Braking Module with braking resistor

Load diagram

L80

2 thermistor protection relays for alarm and fault

Option **L80** offers two thermistor protection relays (with PTB approval) for PTC thermistors (type A) for warning and disconnection. The power supply for the relay and the evaluation is provided within the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals.

Note:

Option **L80** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Meaning (alarm)
= LF–A11:T1	Sensor circuit connection
= LF–A11:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF–A12:T1	Sensor circuit connection
= LF–A12:T2	Sensor circuit connection

L81

2 x 2 thermistor protection relays for alarm and fault

Option **L81** offers four thermistor protection relays (with PTB approval) for PTC thermistors (type A) for warning and disconnection. The power supply for the relay and the evaluation is provided within the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals.

Note:

Option **L81** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Meaning (alarm)
= LF–A11:T1	Sensor circuit connection
= LF–A11:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF–A12:T1	Sensor circuit connection
= LF–A12:T2	Sensor circuit connection

Terminal	Meaning (alarm)
= LF–A21:T1	Sensor circuit connection
= LF–A21:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF–A22:T1	Sensor circuit connection
= LF–A22:T2	Sensor circuit connection

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Options

L82

3 x 2 thermistor protection relays for alarm and fault

Option **L81** offers six thermistor protection relays (with PTB approval) for PTC thermistors (type A) for warning and disconnection. The power supply for the relay and the evaluation is provided within the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals.

Note:

Option **L82** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Meaning (alarm)
= LF-A11:T1	Sensor circuit connection
= LF-A11:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF-A12:T1	Sensor circuit connection
= LF-A12:T2	Sensor circuit connection

Terminal	Meaning (alarm)
= LF-A21:T1	Sensor circuit connection
= LF-A21:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF-A22:T1	Sensor circuit connection
= LF-A22:T2	Sensor circuit connection

Terminal	Meaning (alarm)
= LF-A31:T1	Sensor circuit connection
= LF-A31:T2	Sensor circuit connection

Terminal	Meaning (disconnection)
= LF-A32:T1	Sensor circuit connection
= LF-A32:T2	Sensor circuit connection

L87

Rotor ground-fault monitoring
(static excitation unit, see Accessories, Chapter 7)

Option **L87** provides integrated ground-fault monitoring for the rotor circuit.

L90 to L96

Three Pt100 inputs are available in the standard version. As a consequence, together with one of the options **L90 to L96** the following maximum number of Pt100 inputs can be achieved:

- SINAMICS GM150 in the IGBT version: 9 (with **L91**, **L93** or **L95**)
- SINAMICS GM150 in IGCT version and SINAMICS SM150 in IGCT version: 15 (with **L94** or **L96**)

L90

Pt100 evaluation unit with 3 inputs

The Pt100 evaluation unit can monitor up to three sensors. For all three sensors, the limits for alarm and disconnection must be set centrally.

The output relays are integrated into the internal fault and shutdown sequence of the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L90** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Significance
= LJ-A11:1T1 to 1T3	Pt100; sensor 1
= LJ-A11:2T1 to 2T3	Pt100; sensor 2
= LJ-A11:3T1 to 3T3	Pt100; sensor 3

The sensors can be connected using a two-wire or three-wire system. In a two-wire system inputs xT1 and xT2 must be assigned and a jumper inserted between terminals xT2 and xT3.

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Options

L91

2 Pt100 evaluation units, each with 3 inputs

Each Pt100 evaluation unit can monitor up to three sensors. For all three sensors, the limits for alarm and disconnection must be set centrally.

The output relays are integrated into the internal fault and shut-down sequence of the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L91** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Significance
= LJ-A11:1T1 to 1T3	Pt100; sensor 1
= LJ-A11:2T1 to 2T3	Pt100; sensor 2
= LJ-A11:3T1 to 3T3	Pt100; sensor 3

Terminal	Significance
= LJ-A12:1T1 to 1T3	Pt100; sensor 1
= LJ-A12:2T1 to 2T3	Pt100; sensor 2
= LJ-A12:3T1 to 3T3	Pt100; sensor 3

The sensors can be connected using a two-wire or three-wire system. In a two-wire system inputs xT1 and xT2 must be assigned and a jumper inserted between terminals xT2 and xT3.

L92

3 Pt100 evaluation units each with 3 inputs (SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version)

Each Pt100 evaluation unit can monitor up to three sensors. For all three sensors, the limits for alarm and disconnection must be set centrally.

The output relays are integrated into the internal fault and shut-down sequence of the converter.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L92** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Significance
= LJ-A11:1T1 to 1T3	Pt100; sensor 1
= LJ-A11:2T1 to 2T3	Pt100; sensor 2
= LJ-A11:3T1 to 3T3	Pt100; sensor 3

Terminal	Significance
= LJ-A12:1T1 to 1T3	Pt100; sensor 1
= LJ-A12:2T1 to 2T3	Pt100; sensor 2
= LJ-A12:3T1 to 3T3	Pt100; sensor 3

Terminal	Significance
= LJ-A21:1T1 to 1T3	Pt100; sensor 1
= LJ-A21:2T1 to 2T3	Pt100; sensor 2
= LJ-A21:3T1 to 3T3	Pt100; sensor 3

The sensors can be connected using a two-wire or three-wire system. In a two-wire system inputs xT1 and xT2 must be assigned and a jumper inserted between terminals xT2 and xT3.

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Options

L93

Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control)

The Pt100 evaluation unit can monitor up to six sensors. The limit values can be programmed by the user for each channel.

In the standard setting, the measuring channels are divided into two groups of three channels each. With motors, for example, this means that three Pt100s in the stator windings and two Pt100s in the motor bearings can be monitored. Channels that are not used can be suppressed using appropriate parameter settings.

The output relays are integrated into the internal fault and shut-down sequence of the converter. Two freely programmable analog outputs (0/4 mA to 20 mA and 0/2 V to 10 V) are also available.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals and analog outputs. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L93** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Significance
= LG–A11:T11 to T13	Pt100; sensor 1; group 1
= LG–A11:T21 to T23	Pt100; sensor 2; group 1
= LG–A11:T31 to T33	Pt100; sensor 3; group 1
= LG–A11:T41 to T43	Pt100; sensor 1; group 2
= LG–A11:T51 to T53	Pt100; sensor 2; group 2
= LG–A11:T61 to T63	Pt100; sensor 3; group 2
The sensors can be connected to the Pt100 evaluation unit using either a two-wire or three-wire system. In a two-wire system inputs Tx1 and Tx3 must be assigned. In a three-wire system, input Tx2 must also be connected (x = 1, 2 , ..., 6).	
= LG–A11:11/12/14	Relay output limit for group 1 reached (alarm); changeover contact
= LG–A11:21/22/24	Relay output limit for group 1 reached (fault); changeover contact
= LG–A11:T1 (OUT 1)	Analog output Out 1; sensor group 1
= LG–A11:I1 (OUT 1)	Analog output Out 1; sensor group 1
= LG–A11:31/32/34	Relay output limit for group 2 reached (alarm); changeover contact
= LG–A11:41/42/44	Relay output limit for group 2 reached (fault); changeover contact
= LG–A11:T2 (OUT 2)	Analog output Out 2; sensor group 2
= LG–A11:I2 (OUT 2)	Analog output Out 2; sensor group 2

L94

2 Pt100 evaluation units each with 6 inputs and 2 analog outputs (outputs for display connected to the control; SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version)

Option **L94** offers two Pt100 evaluation units as described under option **L93**, enabling up to 12 sensors in total to be monitored.

Two additional TM31 Terminal Modules are integrated as interfaces for further processing and to display signals and analog outputs. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L94** cannot be combined with options **G61** and **G62** (additional TM31 Terminal Modules), as well as with option **E86** (additional analog inputs).

Terminal	Significance
= LG–A11:T11 to T13	Pt100; sensor 1; group 1
= LG–A11:T21 to T23	Pt100; sensor 2; group 1
= LG–A11:T31 to T33	Pt100; sensor 3; group 1
= LG–A11:T41 to T43	Pt100; sensor 1; group 2
= LG–A11:T51 to T53	Pt100; sensor 2; group 2
= LG–A11:T61 to T63	Pt100; sensor 3; group 2
The sensors can be connected to the Pt100 evaluation unit using either a two-wire or three-wire system. In a two-wire system inputs Tx1 and Tx3 must be assigned. In a three-wire system, input Tx2 must also be connected (x = 1, 2 , ..., 6).	
= LG–A11:11/12/14	Relay output limit for group 1 reached (alarm); changeover contact
= LG–A11:21/22/24	Relay output limit for group 1 reached (fault); changeover contact
= LG–A11:T1 (OUT 1)	Analog output Out 1; sensor group 1
= LG–A11:I1 (OUT 1)	Analog output Out 1; sensor group 1
= LG–A11:31/32/34	Relay output limit for group 2 reached (alarm); changeover contact
= LG–A11:41/42/44	Relay output limit for group 2 reached (fault); changeover contact
= LG–A11:T2 (OUT 2)	Analog output Out 2; sensor group 2
= LG–A11:I2 (OUT 2)	Analog output Out 2; sensor group 2

Terminal	Significance
= LG–A21:T11 to T13	Pt100; sensor 1; group 3
= LG–A21:T21 to T23	Pt100; sensor 2; group 3
= LG–A21:T31 to T33	Pt100; sensor 3; group 3
= LG–A21:T41 to T43	Pt100; sensor 1; group 4
= LG–A21:T51 to T53	Pt100; sensor 2; group 4
= LG–A21:T61 to T63	Pt100; sensor 3; group 4
The sensors can be connected to the Pt100 evaluation unit using either a two-wire or three-wire system. In a two-wire system inputs Tx1 and Tx3 must be assigned. In a three-wire system, input Tx2 must also be connected (x = 1, 2 , ..., 6).	
= LG–A21:11/12/14	Relay output limit for group 3 reached (alarm); changeover contact
= LG–A21:21/22/24	Relay output limit for group 3 reached (fault); changeover contact
= LG–A21:T1 (OUT 1)	Analog output Out 1; sensor group 3
= LG–A21:I1 (OUT 1)	Analog output Out 1; sensor group 3
= LG–A21:31/32/34	Relay output limit for group 4 reached (alarm); changeover contact
= LG–A21:41/42/44	Relay output limit for group 4 reached (fault); changeover contact
= LG–A21:T2 (OUT 2)	Analog output Out 2; sensor group 4
= LG–A21:I2 (OUT 2)	Analog output Out 2; sensor group 4

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Options

L95

Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control)

Six evaluation units are available for use in hazardous areas Zone 2 and Zone 22 (non-conductive dust) Div. 2 and in safe areas (intrinsically safe input: [Ex ia] IIC). The resistance thermometers (Pt100, Pt500, Pt1000) can be operated in a two-wire, three-wire or four-wire system. The six evaluation units are arranged in two groups of three units each. For each group the warning and disconnect messages are arranged together and integrated into the warning and fault reporting chain of the converter. In each group a temperature reading is also led to an analog input of the converter so that it is available to the converter control for measurement and display purposes.

An additional TM31 Terminal Module is integrated as interface for further processing and to display signals and analog outputs. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L95** cannot be combined with option **G61** (additional TM31 Terminal Module).

Terminal	Significance
= LH–A11:10/11/12/14	Pt100; sensor 1; group 1
= LH–A12:10/11/12/14	Pt100; sensor 2; group 1
= LH–A13:10/11/12/14	Pt100; sensor 3; group 1

Terminal	Significance
= LH–A21:10/11/12/14	Pt100; sensor 1; group 1
= LH–A22:10/11/12/14	Pt100; sensor 2; group 1
= LH–A23:10/11/12/14	Pt100; sensor 3; group 1

The sensors can be connected to the Pt100 evaluation unit in either a two-wire, three-wire or four-wire system.
In a two-wire system the inputs 10 and 12 must be connected, in a three-wire system the inputs 10, 11 and 12 and in a four-wire system the inputs 10, 11, 12 and 14 must be connected.
Parameterization is done using software.

L96

2 Pt100 evaluation units each with 6 inputs for explosion-protected motors and 2 analog outputs (outputs for display connected to the control system; SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version)

Two times six evaluation units are available for use in hazardous areas Zone 2 and Zone 22 (non-conductive dust) Div. 2 and in safe areas (intrinsically safe input: [Ex ia] IIC). The resistance thermometers (Pt100, Pt500, Pt1000) can be operated in a two-wire, three-wire or four-wire system. The evaluation units are arranged in groups of three units each. For each group the warning and disconnect messages are arranged together and integrated into the warning and fault reporting chain of the converter. In each group a temperature reading is also led to an analog input of the converter so that it is available to the converter control for measurement and display purposes.

Two additional TM31 Terminal Modules are integrated as interfaces for further processing and to display signals and analog outputs. The terminals that are assigned for the Pt100 evaluation are listed in the following table.

Note:

Option **L96** cannot be combined with options **G61** and **G62** (additional TM31 Terminal Modules), as well as with option **E86** (additional analog inputs).

Terminal	Significance
= LH–A11:10/11/12/14	Pt100; sensor 1; group 1
= LH–A12:10/11/12/14	Pt100; sensor 2; group 1
= LH–A13:10/11/12/14	Pt100; sensor 3; group 1

Terminal	Significance
= LH–A21:10/11/12/14	Pt100; sensor 1; group 1
= LH–A22:10/11/12/14	Pt100; sensor 2; group 1
= LH–A23:10/11/12/14	Pt100; sensor 3; group 1

Terminal	Significance
= LH–A31:10/11/12/14	Pt100; sensor 1; group 1
= LH–A32:10/11/12/14	Pt100; sensor 2; group 1
= LH–A33:10/11/12/14	Pt100; sensor 3; group 1

Terminal	Significance
= LH–A41:10/11/12/14	Pt100; sensor 1; group 1
= LH–A42:10/11/12/14	Pt100; sensor 2; group 1
= LH–A43:10/11/12/14	Pt100; sensor 3; group 1

The sensors can be connected to the Pt100 evaluation unit in either a two-wire, three-wire or four-wire system.
In a two-wire system the inputs 10 and 12 must be connected, in a three-wire system the inputs 10, 11 and 12 and in a four-wire system the inputs 10, 11, 12 and 14 must be connected.
Parameterization is done using software.

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Options

M10

Safety interlocking system

The safety interlocking system is based on the key transfer system developed developed by Castell. It is a supplementary mechanism to the electromagnetic door locking system integrated as standard. To obtain the coded key of the key exchange unit, the medium-voltage circuit breaker must first be opened. The opened medium-voltage circuit breaker releases the keys to the key exchange unit, which in turn releases the keys to the converter cabinet doors of the power unit. This ensures that the converter is isolated from the medium voltage and that the medium voltage is no longer present in the cabinet. As long as the cabinet doors are not closed again and the keys of the converter cabinet doors are not put back into the key exchange unit, the key for the medium voltage circuit breaker will not be released and the medium voltage circuit breaker cannot be reclosed.

M11

Dust protection (air-cooled converters)

With option **M11** the cabinet doors are fitted with additional filter mats to prevent the ingress of dangerous dusts that would otherwise be deposited on the power unit components. The filter mats are fitted to the outside of the cabinet doors, which means that they can be replaced during operation.

A differential pressure technique continually determines the amount of dust in the filter mats. A maintenance request is issued in plenty of time before the filter mats get clogged up.

When replacing the filter mats, it must be ensured that no dust gets into the cabinet unit through the air pulled in by the cabinet fans as they run.

Note:

For SINAMICS SM150 in the IGCT version, the filter mats are already included as standard.

M13

Power cables are connected at the converter input from the top (SINAMICS GM150 in the IGBT version)

Given suitable installation conditions, option **M13** enables the line-side power cable to be introduced into the cabinet unit from the top.

Notice:

Option **M13** increases the width of the cabinet unit by 600 mm. When simultaneously selecting option **L08** (output reactor) or **Y15** (sine-wave filter) the width does not increase. In the case of option **Y15**, the dimensions in the Technical specifications apply.

Note:

Option **M13** is included in option **M78** (power cable connection at the converter output from the top).

M16

Extended dust protection (SINAMICS GM150 in a water-cooled IGBT version)

Opening the cabinet doors before commissioning (e.g. to route connecting cables) can mean, in certain environments, that the converter is polluted, for example as a result of welding operations. Option **M16** involves installing a dust protection cover manufactured out of polycarbonate (Makrolon) inside the converter. This dust protection cover reduces the amount of pollution that can get to the converter components through open doors, therefore minimizing cleaning costs for the converter.

Note:

The commissioning personnel must remove the dust protection cover of the converter prior to commissioning.

M32

Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm²

The signal cable is normally connected directly to the terminals of the TM31 or TM15 Terminal Modules. It must be noted that the maximum connectable cross-section for TM31 and TM15 is limited to 1.5 mm².

With option **M32**, the signals are fed to a terminal strip with spring-loaded terminals. In this case connection cross-sections of up to 2.5 mm² are permitted.

Note:

In conjunction with options **G61**, **G62** and **L80 to L96**, it is not possible to lead out the signals from the additional Terminal Modules.

M33

Customer's terminal strip with screw terminals for signal cables up to 2.5 mm²

The signal cable is normally connected directly to the terminals of the TM31 or TM15 Terminal Modules. It must be noted that the maximum connectable cross-section for TM31 and TM15 is limited to 1.5 mm².

With option **M33**, the signals are fed out to a terminal strip with screw terminals. In this case connection cross-sections of up to 2.5 mm² are permitted.

Note:

In conjunction with options **G61**, **G62** and **L80 to L96**, it is not possible to lead out the signals from the additional Terminal Modules.

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Options

M34

Connection of auxiliary voltage and signal cables from the top (SINAMICS GM150 in the IGBT version)

Given suitable installation conditions, option **M34** enables the auxiliary infeed and the signal cable to be introduced into the cabinet unit from the top.

Note:

Option **M34** requires that option **M32** (customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm^2) or **M33** (customer's terminal strip with screw terminals for signal cables up to 2.5 mm^2) must be simultaneously ordered.

M36

Brass cable entry for power cables (SINAMICS GM150, SINAMICS SM150 in IGCT version)

With option **M36** the converter is supplied with a brass cable entry for the power cables.

For versions with single-core cables, option **M36** is required, so that no circulating currents form in the cable gland.

M42

IP42 degree of protection (SINAMICS GM150 in the air-cooled IGBT version)

With option **M42** , the degree of protection of the air-cooled converters can be enhanced (IP22 is standard). Additional close-meshed grilles where the air comes in and goes out prevent the ingress of solid matter with diameters > 1.0 mm.

M54

IP54 degree of protection (SINAMICS GM150 in the water-cooled version and SINAMICS SM150 in the IGCT version)

With option **M54** , the degree of protection of the water-cooled converters can be enhanced (IP43 is standard).

M61

Redundant fan in the power unit (SINAMICS GM150 in the IGBT version)

To improve system availability, it is possible to equip the converter with an additional redundantly operating fan. If a fan within the converter cabinet unit fails, this is immediately detected by the differential pressure detector in the cabinet and the redundant fan is activated by the converter controller without the converter and hence the drive system failing. This enables production down times or interruptions to be avoided and replacement of the faulty fan to be postponed until the next scheduled shutdown.

Note:

Option **M61** cannot be combined with option **L72** (Braking Module).

Note:

Option **M61** is not available for all converters.

For the following converters, the cabinet width must be increased by 600 mm:

Rated voltage	Converter
2.3 kV	6SL3810-2LM36-0AA0
	6SL3810-2LM37-0AA1
	6SL3810-2LM38-0AA1
3.3 kV	6SL3810-2LN36-0AA0
	6SL3810-2LN37-0AA1
	6SL3810-2LN38-0AA1
4.16 kV	6SL3810-2LP35-3AA1

For the following converters, the cabinet width must be increased by 600 mm and the air intake temperature must be limited to a maximum of +35 °C:

Rated voltage	Converter
4.16 kV	6SL3810-2LP36-0AA0
	6SL3810-2LP37-0AA1
	6SL3810-2LP38-0AA1

The following converters cannot be ordered with option M61:

Rated voltage	Converter
3.3 kV	6SL3810-2LN41-4AA1
4.16 kV	6SL3810-2LP41-1AA0
	6SL3810-2LP41-2AA1
	6SL3810-2LP41-4AA1

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Options

M64

Converter prepared for connection to an external air discharge system, with internal cabinet fans (SINAMICS GM150 in the air-cooled IGBT version)

Retaining the fans inside the cabinet unit ensures that the volume of cool air required for cooling can be supplied without any major distribution faults occurring. If the exhaust air is led in a duct system over long sections or even around bends, the pressure drop that arises in this duct system must be compensated by additional fans within the exhaust air system. Suitable "flange connections" for connecting the converter to an external exhaust air system are located in the roof part of the cabinet unit.

M66

Suitable for marine use (SINAMICS GM150, water-cooled)

With option **M66** , the version of the converter meets the requirements of the following classification organizations:

- Lloyds Register
- American Bureau of Shipping
- Germanischer Lloyd
- Bureau Veritas
- Det Norske Veritas
- Chinese Classification Society

Option **M66** includes a seawater-proof paint finish, a strengthened mechanical design of the cabinet, handrails below the operator panel and a mechanical locking system for the cabinet doors. The cabinet has degree of protection IP44, includes anti-condensation heating (option **L55**) and can be welded to the ship's structure to mount the converter.

Note:

For SINAMICS GM150 in the IGBT version, the cabinet has a reinforced base frame. This increases the cabinet height by 100 mm. (The cabinet in the IGCT version is already equipped with an appropriate base frame as standard).

Note:

With option **M66** the following ambient conditions in operation apply that are changed with respect to the standard values:
Ambient temperature: 0 °C to 45 °C
(derating must be taken into account)
Relative air humidity: 5 % to 95 %

Note:

For SINAMICS GM150 in IGBT version, the combination with option **Y15** (sine-wave filter) on request.

Note:

If the converter is used for a safety-relevant drive ("essential service") on the ship, individual certification is additionally required (options **E11 to E71** see Page 6/12).

Terminal connection overview

When selecting option **M66** , an additional TM31 Terminal Module is required, which provides the additional digital and analog inputs/outputs. An overview is shown in the following table.

Terminal strip on TM31 (=.HC–A71)				
Terminal	Type		Pre-assignment	Comment
X340:				
1-8	P24	24 V DC supply for inputs DI0 to DI7	–	–
X520:				
1	DI0	Digital input electrically isolated via optocoupler	–	–
2	DI1		–	–
3	DI2		–	–
4	DI3		–	–
5	M1	Reference ground for digital inputs DI0 to DI3	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X530:				
1	DI4	Digital input electrically isolated via optocoupler	–	–
2	DI5		–	–
3	DI6		–	–
4	DI7		–	–
5	M2	Reference ground for digital inputs DI4 to DI7	–	–
6	M	Reference ground for P24, auxiliary voltage for digital inputs	–	–
X541:				
1	P24	24 V DC supply for inputs/outputs DI/O8 to DI/DO11	–	–
2	DI/DO8	Digital inputs/ digital outputs non-isolated	–	–
3	DI/DO9		–	–
4	DI/DO10		–	–
5	DI/DO11		–	–
6	M	Reference ground for P24, ground of digital inputs/ digital outputs	–	–

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Options

Terminal strip on TM31 (=.HC-A71)

Terminal	Type		Preassignment	Comment
X521:				
1	AI0+	Analog inputs set up as differential inputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA The voltage input/current input is selected with a switch	Cooling unit flow measurement with 4 ... 20 mA signal	–
2	AI0-			
3	AI1+		–	–
4	AI1-			
5	P10	Auxiliary voltage ± 10 V (10 mA) to connect a potentiometer to enter a setpoint via an analog input	–	–
6	M		–	–
7	N10		–	–
8	M		–	–
X522:				
1	AO 0V+	Analog outputs for the following ranges: -10 ... +10 V +4 ... +20 mA 0 ... +20 mA -20 ... +20 mA	–	–
2	AO 0V-			
3	AO0C+			
4	AO 1V+		–	–
5	AO 1V-			
6	AO 1C+			
7	KTY+	Temperature sensor KTY84 0 ... 200 °C or PTC (R_{cold} < 1.5 kΩ)	–	The sensor type must be parameterized
8	KTY-		–	
X542:				
1	DO 0.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
2	DO 0.COM		–	Basic
3	DO 0.NO		–	NO contact
4	DO 1.NC	Relay output for changeover contact Max. switching voltage: 250 V AC, 30 V DC Max. switching power at 250 V AC: 2000 VA Max. switching power at 30 V DC: 240 W	–	NC contact
5	DO 1.COM		–	Basic
6	DO 1.NO		–	NO contact

M78

Power cables at the converter output are connected from the top (SINAMICS GM150 in the IGBT version)

Given suitable installation conditions, option **M78** enables the motor-side power cable to be introduced into the cabinet unit from the top.

Option **M78** includes option **M13** (power cable connection at the converter input from the top).

Notice:

Option **M78** increases the cabinet width by 600 mm. When simultaneously selecting option **L08** (output reactor) or **Y15** (sine-wave filter) the width does not increase. In the case of option **Y15**, the dimensions in the Technical specifications apply.

N06 to N08

Capacitor Modules to increase the DC link capacitance (SINAMICS SM150 in IGCT version)

With options **N06 to N08** the converter is shipped with Capacitor Modules to increase the DC link capacitance. The increase for each sub DC link is 6, 12 or 18 mF.

Note:

Options **N06 to N08** are only available for the basic and parallel connections with order numbers 6SL3845-7NN42-2AA0, 6SL3845-7NN44-5AA0 and 6SL3845-7NN46-7AA0. They are not available for DC bus configurations.
With these options, the cabinet width per converter unit is increased (see the following table).

Number of Capacitor Modules	Option	Additional cabinet width per converter unit	DC link capacitance per sub DC link
0	–	–	12 mF
1	**N06**	970 mm	18 mF
2	**N07**	1940 mm	24 mF
3	**N08**	2910 mm	30 mF

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Options

N13

Circuit breaker at the converter input (SINAMICS GM150, for 24-pulse Basic Line Module on request; not available for the IGCT version with converter units operated in parallel; SINAMICS SM150 in the IGCT version on request)

Option **N13** provides integrated circuit breakers. Option **N13** is particularly important in the retrofit business where existing circuit breakers do not meet requirements (tripping times, low-voltage coil). The circuit breakers are installed below the Basic Line Module in the converter cabinet and are thus located on the secondary side of the line-side transformer.

Notice:

Option N13 increases the width of the cabinet as follows:

- SINAMICS GM150 in the IGBT version: 600 mm
- SINAMICS GM150 in the IGCT version: 2 × 700 mm

Note:

In conjunction with option **C55** (auxiliary power supply for open-loop and closed-loop control), as well as for converters with 24-pulse Basic Line Module, for option **N13** a special request is required.

N15

24-pulse Basic Line Module (SINAMICS GM150)

For particularly high requirements regarding low line harmonics, the power units of voltage ranges 2.3 kV, 3.3 kV and 4.16 kV can be equipped with a 24-pulse Basic Line Module. (circuit version (2) for IGBT version, circuit version (8) for IGCT version).

Converters with higher power ratings with power units connected in parallel can also be operated without this 24-pulse option (circuit version (3)). The converter transformer required at the medium-voltage level must be designed as a five-winding transformer, or else two two-tier transformers must be provided. Vector groups and winding offsets must be appropriately engineered.

Notice:

With the option **N15** the width of the converter cabinet for SINAMICS GM150 as IGBT version increases by 600 mm.

Note:

For SINAMICS GM150 in the IGCT version, option **N15** cannot be combined with option **L72** (Braking Module), and a request is required in conjunction with option **L48** (make-proof grounding switch at the converter input).

(2) SINAMICS GM150 in IGBT version, basic circuit 2.3 kV to 4.16 kV (Option **N15**)
(3) SINAMICS GM150 in IGBT version, parallel connection 2.3 kV to 4.16 kV (24-pulse infeed as standard)
(8) SINAMICS GM150 in IGCT version (option **N15**)

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Options

The circuit for the 24-pulse infeed is implemented in different ways for SINAMICS GM150 in the IGBT version and in the IGCT version. The two following diagrams should clearly show the principle difference between the parallel connection (for IGBT) and the series connection (for IGCT). The Basic Line Modules (each with two diode rectifiers) are supplied from two 3-winding transformers with ±7.5° shift on the primary side. 12-pulse operation applies as a result of the 30° phase shift between the two rectifiers of a DC link half. For the same load of the halves, 24-pulse operation is achieved as the infeeds of the two DC link halves are phase shifted through 15° with respect to one another. In the case of IGBTs, the deviation of the secondary voltage of a transformer under load conditions may be a maximum of 1 %.

SINAMICS GM150 in the IGBT version, 24-pulse infeed by connecting two Basic Line Modules in parallel (absolute values of the individual phase shift angles as example only)

SINAMICS GM150 in the IGCT version, 24-pulse infeed by connecting two Basic Line Modules in series (absolute values of the individual phase shift angles as example only)

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Options

N20

110 V to 120 V DC capacitor tripping device (SINAMICS GM150 in the IGBT version)

The capacitor tripping device is used if the existing circuit breaker has no undervoltage coil and cannot be retrofitted with one.

It is installed in the converter and has the following functions:

- Monitoring of the auxiliary voltage supply of the circuit breaker on the plant side
- Monitoring of the own internal voltage supply
- Locking of the circuit breaker in the open position if there is insufficient voltage

The capacitor tripping device ensures that the circuit breaker on the plant side can still be safely opened even if there is a power failure or the normal OPEN command is not effective, e.g. because of wire breakage.

N21

230 V DC capacitor tripping device (SINAMICS GM150 in the IGBT version)

The capacitor tripping device is used if the existing circuit breaker has no undervoltage coil and cannot be retrofitted with one.

It is installed in the converter and has the following functions:

- Monitoring of the auxiliary voltage supply of the circuit breaker on the plant side
- Monitoring of the own internal voltage supply
- Locking of the circuit breaker in the open position if there is insufficient voltage

The capacitor tripping device ensures that the circuit breaker on the plant side can still be safely tripped even if there is a power failure or the normal OFF command is not effective, e.g. because of a wire break.

N22

Switch on the input side (static excitation unit, see Accessories, Chapter 7)

When option **N22** is chosen, a circuit breaker which is controlled by the static excitation unit itself is integrated on the input side. On the variants for brushless reverse field excitation this circuit breaker is configured as a contactor, on the variants for slipring excitation as a disconnector.

Note:

If this circuit breaker is not available, an external circuit breaker must be provided.

N30 to N33

Controlled motor feeder for auxiliaries 400 V 3 AC/480 V 3 AC

An outgoing feeder for the operation of external auxiliary equipment, e.g. separate fans on the motor or pumps/oil supplies, is available in the converter. It is controlled and is fused by motor circuit breakers. The voltage supply required for the drive must be provided from an external source.

Depending on the drive output that is required, four different outgoing feeders are available.

The contactor is closed with the **ON** command at the converter and opened with the **OFF** command.

Option	Description
N30	Controlled motor feeder for auxiliaries 50 Hz 400 V 3 AC, max. 4 kW or 60 Hz 480 V 3 AC, max. 4.8 kW (cos φ = 0.8; setting range of the motor circuit breaker from 9 A to 12.5 A)
N31	Controlled motor feeder for auxiliaries 50 Hz 400 V 3 AC, max. 7 kW or 60 Hz 480 V 3 AC, max. 8 kW (cos φ = 0.8; setting range of the motor circuit breaker from 14 A to 20 A)
N32	Controlled motor feeder for auxiliaries 50 Hz 400 V 3 AC, max. 11 kW or 60 Hz 480 V 3 AC, max. 12.7 kW (cos φ = 0.8; setting range of the motor circuit breaker from 18 A to 25 A)
N33	Controlled motor feeder for auxiliaries 50 Hz 400 V 3 AC, max. 15 kW or 60 Hz 480 V 3 AC, max. 17.5 kW (cos φ = 0.8; setting range of the motor circuit breaker from 28 A to 40 A)

Note:

Other voltages are also possible according to the ratings in question.

Note:

It is not possible to combine several options (**N30 to N33**).

Auxiliary voltage infeed	Outgoing feeder for auxiliaries	Protective circuit breaker external power supply ON	
= GC–X1:1 L1	= GC–X1:4 L1	= GC–X2:1	Relay contact, max. 60 V DC
= GC–X1:2 L2	= GC–X1:5 L2	= GC–X2:2	
= GC–X1:3 L3	= GC–X1:6 L3		

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Options

N35 to N38

Controlled outgoing feeder for auxiliaries 230 V 1 AC/120 V 1 AC

A controlled outgoing feeder protected by miniature circuit breakers is available in the converter for controlling external auxiliaries, e.g. the anti-condensation heating for the motor. The infeed required for the voltage supply, e.g. the anti-condensation heating, must be provided externally.

Depending on the output that is required, four different outgoing feeders are available.

The contactor is opened with the **ON** command at the converter and closed with the **OFF** command.

Option	Description
N35	Controlled outgoing feeder for auxiliaries 50 Hz 230 V 1 AC, max. 1.2 kW or 60 Hz 120 V 1 AC, max. 1 kW
N36	Controlled outgoing feeder for auxiliaries 50 Hz 230 V 1 AC, max. 2.2 kW or 60 Hz 120 V 1 AC, max. 1.5 kW
N37	Controlled outgoing feeder for auxiliaries 50 Hz 230 V 1 AC, max. 3.5 kW or 60 Hz 120 V 1 AC, max. 2.1 kW
N38	Controlled outgoing feeder for auxiliaries 50 Hz 230 V 1 AC, max. 4.5 kW or 60 Hz 120 V 1 AC, max. 2.8 kW

Note:

It is not possible to combine several options (**N35 to N38**).

Auxiliary voltage infeed	Outgoing feeder for auxiliaries	Protective circuit breaker external power supply ON	
= GC–X1:7 L1	= GC–X1:9 L1	= GC–X2:3	Relay contact, max. 60 V DC
= GC–X1:8 N	= GC–X1:10 L2	= GC–X2:4	

Q80 to Q85

Extension of the liability for defects

For a description, refer to services and documentation, Pages 10/12 and 10/13.

S05

Basic configuration (SINAMICS SM150)

Option **S05** provides a system-specific software configuration, which is absolutely necessary for the correct functioning of the SINAMICS SM150 converter system. If option **S05** is not selected, then a system integrator must carry out this basic configuration.

The basic configuration includes:

- Connection of the static excitation unit via PROFIBUS
- Operation of the SIMATIC OP 177B operator panel
- Signal marshaling to connect to the basic automation (e.g. ON/OFF or fault signals from Motor Modules)

T58, T60, T80, T85, T90, T91

Rating plate languages

The rating plate is normally supplied in two languages (English/German). Other languages can be ordered using the codes below.

Option	Description
T58	Rating plate in English/French
T60	Rating plate in English/Spanish
T80	Rating plate in English/Italian
T82	Rating plate in English/Portuguese (on request)
T85	Rating plate in English/Russian (on request)
T86	Rating plate in English/Polish (on request)
T90	Rating plate in English/Japanese (on request)
T91	Rating plate in English/Chinese (on request)

Note:

It is not possible to combine several options (**T58 to T91**).

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Options

W02

Cooling unit with redundant stainless steel plate-type heat exchangers (for water cooling)

The cooling unit is used to dissipate the power loss from the converter and consists of two cooling circuits: the internal cooling circuit with deionized water and the external raw water circuit for dissipating the power loss. In the standard version the internal cooling circuit has two redundant circulating pumps and one stainless steel plate-type heat exchanger. With option **W02** , a second stainless steel plate-type heat exchanger is integrated to enable fully redundant operation.

W11

Cooling unit with a titanium plate-type heat exchanger (for water cooling)

If the raw water specified in the Technical specifications is not available for the cooling unit, option **W11** must be selected. This is required in the case of aggressive raw water such as seawater, for instance. With option **W11** , a titanium plate-type heat exchanger is installed instead of the stainless steel plate-type heat exchanger. The three-way valve for preventing condensation and the necessary pipe connections are still made from stainless steel.

Notice:

When option **W11** is chosen, the piping on the raw water side is manufactured of stainless steel and not titanium.

W12

Cooling unit with redundant titanium plate-type heat exchangers (for water cooling)

With option **W12**, two completely redundant titanium plate-type heat exchangers are integrated for the internal cooling circuit (other characteristics as described under option **W11**).

Notice:

When option **W12** is chosen, the piping on the raw water side is manufactured of stainless steel and not titanium.

W14

Converter without cooling unit. This must be provided on the plant side (for water cooling)

When option **W14** is chosen, the water-cooled converter is supplied without a cooling unit. The necessary cooling system must be provided on the plant side.

Note:

Option **W14** reduces the width and weight of the cabinet (data available on request).

W20

Raw-water connection from the bottom (SINAMICS GM150 in the IGBT version)

Option **W20** enables the raw water for the cooling unit to be supplied from the bottom through the cabinet floor with a flange connection. The necessary mating flanges are included as a pack with the cooling unit.

Note:

With water-cooled IGBT converters, the raw water is supplied to the cooling unit through the side panel from the left-hand side. For converters in IGCT technology, the raw water is connected at the cooling unit from the bottom.

Y05

Customer-specific rating plate

With option **Y05** the data on the rating plate can be adapted for the specific plant or system, depending on the ambient conditions such as installation altitude or ambient temperature. This also involves data regarding the rated voltage, rated current and the frequency range at the converter output. The maximum values of the adapted rating plate are defined by the values of the standard rating plate, which correspond to the catalog data.

Y09

Special paint finish according to RAL...

Converters are normally supplied in RAL 7035 (light gray). With option **Y09** a special color can be ordered by specifying plain text.

Note:

For SINAMICS GM150 in the air-cooled version, the following applies: The fans still have the standard RAL 7035 color even when the cabinet has a special paint finish.

Y10

Customer-specific circuit diagrams

The circuit diagrams are given customized headers.

The data for the header must be specified in plain text (up to three lines, with 45 characters per line).

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Options

Y15

Sine-wave filter (SINAMICS GM150 in the IGBT version and SINAMICS SM150 in the IGBT version on request)

Sine-wave filters are required for the following applications:

- When operating old motors (retrofit)
- When operating third-party motors without taking supplementary measures for converter operation

The sine-wave filters supply the motors with almost sinusoidal motor currents and voltages so that line motors can be operated. The sine-wave filter operates optimally for motors with a rated frequency of 50 Hz or 60 Hz. It should be noted that only driven loads with a square-law load torque may be operated (e.g. pumps, fans). The output frequencies used in operation can lie in the range between 30 Hz and 66 Hz.

A field weakening range of 1:1.1 is permissible (max. 55 Hz for 50 Hz motors and max. 66 Hz for 60 Hz motors).

When sine-wave filters are used, the voltage harmonic distortion at an output frequency of 50 Hz is less than 5 %.

If the sine-wave filter is used, the output of the converter must be reduced (see Technical specifications).

Note:

The rated motor current, the motor current in the operating point and the motor no-load current must be given in plain text when ordering filters.

Converter	**Max. cable lengths**			
	Without sine-wave filter (standard)		With sine-wave filter [1] (option **Y15**)	
	Shielded	Un-shielded	Shielded	Un-shielded [2]
Output voltage 2.3 kV to 4.16 kV				
SINAMICS GM150 as IGBT version	Up to 2 parallel cables: 100 m 3 parallel cables: 80 m >3 parallel cables: Not permitted	Not permitted	1000 m	1000 m

Notice:

Option **Y15** increases the width of the cabinet unit (for dimensions see Technical specifications).

Y17

Line reactor (static excitation unit, see Accessories, Chapter 7)

With the option **Y17** a line reactor is integrated to protect against excessive harmonic currents and to limit the circuit feedbacks. The exact values for the reactor must be given in plain text as they are dependent on the supplying network.

Y40

Raw water data deviating from the catalog data (with water cooling, on request)

With option **Y40**, raw water whose data does not conform to the Technical specifications can also be used with water-cooled converters (for specifications, see Cooling unit, Pages 9/8 and 9/9). Deviations from the values indicated in the specification must be clarified in advance.

Y73

Braking resistor (SINAMICS SM150 on request only)

The braking resistor is connected to the Braking Module (option **L72**) via two connections (SINAMICS GM150 in the IGBT version) or three connections (SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version). For dimensioning, refer to the Table in the description for option **L72**, Page 6/27.

Notice:

The power loss of the braking resistor must be taken into account when dimensioning the room or the area in which the converters is mounted. If required, the braking resistor should be mounted outside the room/area. The braking resistor is equipped with a temperature monitor. This must be connected up so that when it responds, the converter is shut down. Regarding inductance L, the following requirements apply to the braking resistor and cable routing: The time constant L/R must not exceed 20 µs, i.e. L must be less than $R \times 20$ µs.

The signal cables to the temperature monitoring and the power cable are not included in the scope of supply.

Note:

When ordering, the following data must be specified in plain text: max. rated power, braking duration and cycle. The Technical specifications are obtained, based on this data (for example, dimensions, weight), whereby the following basic data apply to all resistors:

- Degree of protection IP20, with perforated sheet steel roof section manufactured out of V2A steel
- Cooling using an internal fan
- Digital feedback signal from the air flow switch and temperature switch
- Mounted outside the converter, in electrical rooms and areas
- Ambient temperature: max. converter ambient temperature
- Enclosure, painted, RAL 7035

[1] Distance between the converter and the motor depending on the current load for max. 6 three-wire EMC cables connected in parallel.

[2] Armored cables are recommended.

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Accessories

7

7/2 **Accessories for grounding and short-circuiting the converter**

7/2 **Accessories for replacing phase modules**

7/2 **Static excitation units**
7/3 Static excitation units for brushless rotating reverse-field excitation
7/7 Static excitation units for slipring excitation

7/13 **STARTER commissioning tool**

7/14 **Engineering Software Drive ES**

7/15 **SIMOTION SCOUT V4.2 software package**

7/18 **SIMOTION Runtime Software for SINAMICS SM150**

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Accessories for grounding and short-circuiting the converter

Overview

Accessories for grounding and short-circuiting the converter for commissioning and maintenance work

For safety reasons, devices for grounding and short-circuiting the converter are required for work on the converter in the de-energized state (EN 61230/VDE 0683-100 (IEC 61230)). They are required for commissioning or service work, for example, as well as for replacing fans or Power cards/phase modules.

As some of this work has to be performed by operator personnel with the relevant training, the specified tools must be available on the equipment. If these devices are not available, the work must not be performed due to the electrical hazards.

In the case of SINAMICS GM150 and SINAMICS SM150, spherical grounding points are fitted on the input and output side in the area of the connecting bar which can be short-circuited and grounded with an appropriate three-pole grounding device (grounding harness).

As a rule, this must be done in the de-energized state for all work (in the case of converters with a power unit connected in parallel at both infeed points or motor feeders).

If appropriate devices are not available on the equipment, the relevant converter accessories must be supplied in the requisite quantity.

Please note in this case that the number of three-pole grounding devices required is dependent on the number of infeeding three-phase current systems. One grounding device per three-phase current system is required.

If there is a risk of power being fed from the motor side back into the converter, one grounding device per three-phase current system must be fitted here as well.

Selection and ordering data

Description	Order No.
Grounding bar 1000 mm, to connect the grounding device	**6SY8101-0AB54**
Three-pole grounding device (grounding harness) for 20 mm spherical grounding points for grounding and short-circuiting the DC link	**6SY8101-0AB55**
Three-pole grounding device (grounding harness) with universal terminals	**6SY8101-0AB58**

Accessories for replacing phase modules

Overview

Accessories for replacing phase modules (SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version)

The phase modules of the converters with IGCT power semiconductors (SINAMICS GM150 in the IGCT version and SINAMICS SM150 in the IGCT version) can be completely replaced by trained personnel. To replace, the entire phase module must be extracted from the converter using a special lifting tool and transported on a stacker truck.

Selection and ordering data

Description	Order No.
Contact spray	**6SC8476-1DA00-0AA0**
Forklift truck RHM23 standard	**6SC8476-1EA00-0AA0**
Replacement equipment (roller track)	**6SL3986-6YX00-0AA0**

Static excitation units

Overview

The following versions are available as static excitation units for SINAMICS GM150 and SINAMICS SM150:

- Static excitation unit for separately excited synchronous motors with brushless rotating reverse-field excitation
- Static excitation unit for separately excited synchronous motors with slipring excitation

Control with both versions is performed by the converter through a PROFIBUS interface.

A static excitation unit must always be ordered together with the converter but it has its own order number.
Add "-Z" to the order number of the converter and specify the code E01 or E02.
The static excitation unit cannot be ordered on its own.

Note:

The option **G30** (PROFIBUS master) must also be ordered in conjunction with SINAMICS GM150.

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Selection and ordering data

Rated current A	Comment	Static excitation unit Order No.
For supply voltage 500 V 3 AC		
130	–	**6RN7030-1RH31-3AA0**
250	–	**6RN7030-2RH32-5AA0**
250	Can only be ordered together with option **M66** (suitable for marine applications).	**6RN7031-1RH32-5AA0-Z M66**
For supply voltage 690 V 3 AC		
130	–	**6RN7030-1RF31-3AA0**
250	–	**6RN7030-2RF32-5AA0**
250	Can only be ordered together with option **M66** (suitable for marine applications).	**6RN7031-1RF32-5AA0-Z M66**

Accessories

Designation	Order No.
PROFIBUS connecting cable between the basic unit and static excitation unit	
PROFIBUS cable	**6XV1830-0EH10**
Connector for PROFIBUS	
• Without PG/PC connection	**6ES7972-0BA41-0XA0**
• With PG/PC connection	**6ES7972-0BB41-0XA0**

Options

When ordering a device with options, add **"-Z"** to the order number of the device, followed by the order code(s) for the desired option(s).

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options	
Circuit breaker on input side (configured as a contactor)	**N22**

Output-side options	
Disconnector at the output for redundancy [1]	**L51**

[1] Option **L51** can only be ordered in conjunction with option **M66** (suitable for marine applications).

Connection of power and signal cables		**M13**	**M78**	**M34**
Power cable connected at the input from the top (on request) [1]	**M13**		✓	✓
Power cable connected at the output from the top (on request) [1]	**M78**	✓		✓
Auxiliary voltage and signal cables connected from the top	**M34**	✓	✓	

[1] If options **M13** and/or **M78** are selected, then an additional cabinet (width 600 mm × depth 600 mm) is required.

✓ Options can be combined

– Options are mutually exclusive

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Options

PROFIBUS communication (SINAMICS GM150)	
PROFIBUS master	**G30**

Industry-specific options	
Suitable for marine applications [1]	**M66**

[1] Option **M66** is only available for static excitation units 6RN7031-1RH32-5AA0-Z and 6RN7031-1RF32-5AA0-Z.

Documentation (standard: PDF format in English on CD-ROM)		D00	D02	D15	D56	D57	D72	D76	D77	D78	D84	Y10
Documentation in German	**D00**		✓	✓	–	–	–	✓	–	–	–	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	**D02**	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
One set of printed documentation (multiple orders possible)	**D15**	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Documentation in Russian (on request)	**D56**	–	✓	✓		–	–	✓	–	–	–	✓
Documentation in Japanese (on request)	**D57**	–	✓	✓	–		–	✓	–	–	–	✓
Documentation in Italian (on request)	**D72**	–	✓	✓	–	–		✓	–	–	–	✓
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	**D76**	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French (on request)	**D77**	–	✓	✓	–	–	–	✓		–	–	✓
Documentation in Spanish (on request)	**D78**	–	✓	✓	–	–	–	✓	–		–	✓
Documentation in Chinese (on request)	**D84**	–	✓	✓	–	–	–	✓	–	–		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	**Y10**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91
Rating plate in English/French	**T58**		–	–	–	–	–	–	–
Rating plate in English/Spanish	**T60**	–		–	–	–	–	–	–
Rating plate in English/Italian	**T80**	–	–		–	–	–	–	–
Rating plate in English/Portuguese (on request)	**T85**	–	–	–		–	–	–	–
Rating plate in English/Russian (on request)	**T85**	–	–	–	–		–	–	–
Rating plate in English/Polish (on request)	**T86**	–	–	–	–	–		–	–
Rating plate in English/Japanese (on request)	**T90**	–	–	–	–	–	–		–
Rating plate in English/Chinese (on request)	**T91**	–	–	–	–	–	–	–	

✓ Options can be combined
– Options are mutually exclusive

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Options

Auxiliary voltage supply	
Auxiliary voltage other than N/400 V/3 AC (primary voltage must be specified in plain text; available: 110, 220, 240, 380 and 400 V 3 AC)	**Y75**

Device acceptance inspections in presence of customer		F03	F73	F77	F97
Visual acceptance	**F03**		–	–	–
Functional acceptance with inductive load	**F73**	–		✓	–
Acceptance of the insulation test [1]	**F77**	–	✓		–
Customer-specific acceptance (on request)	**F97**	–	–	–	

[1] Option **F77** requires that option **F73** is simultaneously ordered.

Miscellaneous options		L50	L55	Y09
Cabinet lighting and service socket outlet	**L50**		✓	✓
Anti-condensation heating for the cabinet	**L55**	✓		✓
Special paint finish to RAL .... (in a color other than RAL 7035; plain text required)	**Y09**	✓	✓	

✓ Options can be combined
– Options are mutually exclusive

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Technical specifications

Brushless rotating reverse-field excitation		6RN7030-1RH31-3AA0 6RN7030-1RF31-3AA0	6RN7030-2RH32-5AA0 6RN7030-2RF32-5AA0	6RN7031-1RH32-5AA0-Z M66 6RN7031-1RF32-5AA0-Z M66
Rated current	A	130	250	250
Supply voltage	V	500 V 3 AC or 690 V 3 AC	500 V 3 AC or 690 V 3 AC	500 V 3 AC or 690 V 3 AC
Voltage range		110 V -10 % to 500 V +10 %	110 V -10 % to 500 V +10 %	110 V -10 % to 500 V +10 %
Rated supply frequency	Hz	50/60	50/60	50/60
Frequency range	Hz	45 ... 65	45 ... 65	45 ... 65
Power loss at rated current (SIMOTRAS HD)	kW	1.3	2 × 1.3	1.3
Electronics power supply		400 V 2 AC, 1 A or 230 V 1 AC, 2 A	400 V 2 AC, 1 A or 230 V 1 AC, 2 A	400 V 2 AC, 1 A or 230 V 1 AC, 2 A
Fan power supply		Without fan	Without fan	400 V 3 AC, 50 Hz, 0.24 A 460 V 3 AC, 60 Hz, 0.24 A
Max. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [1]	A	16	16	16
Max. current demand of the auxiliary supply 400 V 3 AC 50/60 Hz	A	–	–	6
Cooling air flow rate	m^3/s	–	–	0.85
Sound pressure level L_{pA} (1 m)	dB	<73	<73	<73
Measuring surface level L_s (1 m)	dB	16	16	16
Cable cross-sections, line-side, max. connectable per phase	mm^2 (DIN VDE)	1 × 70	2 × 70	2 × 70
	AWG/MCM (NEC, CEC)	1 × 3/0 AWG/ 1 × 138 MCM	2 × 3/0 AWG/ 2 × 138 MCM	2 × 3/0 AWG/ 2 × 138 MCM
Cable cross-sections, motor-side, max. connectable per phase	mm^2 (DIN VDE)	1 × 70	2 × 70	2 × 70
	AWG/MCM (NEC, CEC)	1 × 3/0 AWG/ 1 × 138 MCM	2 × 3/0 AWG/ 2 × 138 MCM	2 × 3/0 AWG/ 2 × 138 MCM
PE connection, max. connection cross-section at enclosure with M12 screw	mm^2 (DIN VDE)	1 × 70	1 × 70	1 × 70
	AWG/MCM (NEC, CEC)	1 × 3/0 AWG	1 × 3/0 AWG	1 × 3/0 AWG
Degree of protection		IP42	IP42	IP44
Dimensions (with doors and panels)				
• Width	mm	600	1200	600
• Height	mm	2300	2300	2200
• Depth	mm	600	600	600
Weight	kg	300	400	300

[1] Data without taking options into account.

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Selection and ordering data

Rated DC current	Supply voltage	Comment	Static excitation unit
A	V		Order No.
600	400 3 AC	–	**6RN7011-5SE36-0AA0**
400	460 3 AC	Suitable for marine applications	**6RN7011-5SE34-0AA0-Z M66**
1200	460 3 AC	–	**6RN7011-2SE41-2AA0**
1200	460 3 AC	Compact	**6RN7011-3SE41-2AA0**
1900	830 3 AC	–	**6RN7011-0SJ42-0AA0**
2000	690 3 AC	–	**6RN7011-1SH42-0AA0**
2200	950 3 AC	–	**6RN7011-6SK42-2AA0**

Accessories

Designation	Order No.
PROFIBUS connecting cable between the basic unit and static excitation unit	
PROFIBUS cable	**6XV1830-0EH10**
Connector for PROFIBUS	
• Without PG/PC connection	**6ES7972-0BA41-0XA0**
• With PG/PC connection	**6ES7972-0BB41-0XA0**

Note:

The slipring excitation units can be ordered with a SINAMICS DC MASTER power unit on request.

Options

When ordering a device with options, add **"-Z"** to the order number of the device, followed by the order code(s) for the desired option(s).

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options		**N22**	**Y17**
Circuit breaker on input side [1] (configured as a disconnector)	**N22**		✓
Line reactor [2] (plain text is required)	**Y17**	✓	

[1] Option **N22** is not available for the compact static excitation unit 6RN7011-3SE41-2AA0. In this case a circuit breaker must be provided on the plant side.

[2] Option **Y17** is not available for the static excitation units 6RN7011-3SE41-2AA0 and 6RN7011-0SJ42-0AA0. With option **Y17**, the cabinet size can vary – depending on the reactor.

✓ Options can be combined

– Options are mutually exclusive

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Options

Protective functions		L21	L87
Overvoltage protection AC [1]	L21		✓
Isolation monitoring device for rotor system	L87	✓	

[1] Option **L21** is not available for the compact static excitation unit 6RN7011-3SE41-2AA0. In this case, AC overvoltage protection must be provided on the plant side. Otherwise a connection voltage of 200 V must not be exceeded.

Enhanced protection for cabinet units		M11	M43
Dust protection	M11		–
IP43 degree of protection	M43	–	

Connection of power and signal cables		M13	M78	M34
Power cable connected at the input from the top [1] (on request)	M13		✓	✓
Power cable connected at the output from the top [1] (on request)	M78	✓		✓
Auxiliary voltage and signal cables connected from the top	M34	✓	✓	

[1] If options **M13** and/or **M78** are selected, then an additional cabinet (width 600 mm × depth 600 mm) is required.

PROFIBUS communication (SINAMICS GM150)	
PROFIBUS master	G30

Industry-specific options	
Suitable for marine applications [1]	M66

[1] Option **M66** is only available for version 6RN7011-5SE34-0AA0-Z.

✓ Options can be combined
– Options are mutually exclusive

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Options

Documentation (standard: PDF format in English on CD-ROM)		D00	D02	D15	D56	D57	D72	D76	D77	D78	D84	Y10
Documentation in German	D00		✓	✓	–	–	–	✓	–	–	–	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format [1]	D02	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
One set of printed documentation (multiple orders possible)	D15	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Documentation in Russian (on request)	D56	–	✓	✓		–	–	✓	–	–	–	✓
Documentation in Japanese (on request)	D57	–	✓	✓	–		–	✓	–	–	–	✓
Documentation in Italian (on request)	D72	–	✓	✓	–	–		✓	–	–	–	✓
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French (on request)	D77	–	✓	✓	–	–	–	✓		–	–	✓
Documentation in Spanish (on request)	D78	–	✓	✓	–	–	–	✓	–		–	✓
Documentation in Chinese (on request)	D84	–	✓	✓	–	–	–	✓	–	–		✓
Circuit diagrams with customer-specific text field (plain text required) [1]	Y10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

[1] The equipment-specific documents (circuit diagrams etc.) are only available in English/German.

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91
Rating plate in English/French	T58		–	–	–	–	–	–	–
Rating plate in English/Spanish	T60	–		–	–	–	–	–	–
Rating plate in English/Italian	T80	–	–		–	–	–	–	–
Rating plate in English/Portuguese (on request)	T82	–	–	–		–	–	–	–
Rating plate in English/Russian (on request)	T85	–	–	–	–		–	–	–
Rating plate in English/Polish (on request)	T86	–	–	–	–	–		–	–
Rating plate in English/Japanese (on request)	T90	–	–	–	–	–	–		–
Rating plate in English/Chinese (on request)	T91	–	–	–	–	–	–	–	

✓ Options can be combined

– Options are mutually exclusive

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Options

Auxiliary voltage supply	
Auxiliary voltage other than N/400 V/3 AC (primary voltage must be specified in plain text; available: 110, 220, 240, 380 and 400 V 3 AC)	**Y75**

Device acceptance inspections in presence of customer		F03	F73	F77	F97
Visual acceptance	**F03**		–	–	–
Functional acceptance with inductive load	**F73**	–		✓	–
Acceptance of the insulation test [1]	**F77**	–	✓		–
Customer-specific acceptance (on request)	**F97**	–	–	–	

[1] Option **F77** requires that option **F73** is simultaneously ordered.

Miscellaneous options		L50	L55	Y09	M06
Cabinet lighting and service socket outlet	**L50**		✓	✓	✓
Anti-condensation heating for the cabinet	**L55**	✓		✓	✓
Special paint finish acc. to RAL..... (in a color other than RAL 7035; plain text required)	**Y09**	✓	✓		✓
100 mm base (base frame in the cabinet color)	**M06**	✓	✓	✓	

✓ Options can be combined
– Options are mutually exclusive

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Technical specifications

Slipring excitation unit		6RN7011-5SE36-0AA0	6RN7011-5SE34-0AA0-Z M66	6RN7011-2SE41-2AA0	6RN7011-3SE41-2AA0
Rated DC current	A	600	400	1200	1200
Supply voltage	V	400 V 3 AC	460 V 3 AC	460 V 3 AC	460 V 3 AC
Voltage range	%	-20 ... +15	-20 ... +15	-20 ... +15	-20 ... +15
Rated supply frequency	Hz	50/60	50/60	50/60	50/60
Frequency range	Hz	45 ... 65	45 ... 65	45 ... 65	45 ... 65
Power loss at rated current (SIMOTRAS HD)	kW	1.8	1.8	4.7	4.7
Electronics power supply		230 V 1 AC, 2 A	400 V 2 AC, 1 A or 230 V 1 AC, 2 A	230 V 1 AC, 2 A	230 V 1 AC, 2 A
Fan power supply		400 V 3 AC, 50 Hz, 0.3 A 460 V 3 AC, 60 Hz, 0.3 A	400 V 3 AC, 50 Hz, 0.55 A 460 V 3 AC, 60 Hz, 0.55 A	230 V 1 AC, 50/60 Hz, 2.6/3.3 A	230 V 1 AC, 50/60 Hz, 2.6/3.3 A
Max. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [1]	A	2.5	16	5.1	5.1
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	Plant-specific, typical 50	6	–	–
Cooling air flow rate	m^3/s	0.16	0.85	0.36	0.36
Sound pressure level L_{pA} (1 m)	dB	<73	<76	<76	<76
Measuring surface level L_s (1 m)	dB	17	17	17	16
Cable cross-sections, line-side, max. connectable per phase	mm^2 (DIN VDE)	2 × 185	1 × 95	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	2 × 350 MCM	1 × 3/0 AWG	4 × 500 MCM	4 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase	mm^2 (DIN VDE)	2 × 240	2 × 95	4 × 240	4 × 240
	AWG/MCM (NEC, CEC)	2 × 500 MCM	2 × 3/0 AWG	4 × 500 MCM	4 × 500 MCM
PE connection, max. connection cross-section at enclosure with M12 screw	mm^2 (DIN VDE)	1 × 185	1 × 50	2 × 240	2 × 240
	AWG/MCM (NEC, CEC)	1 × 350 MCM	1 × 1/0 AWG	2 × 500 MCM	2 × 500 MCM
Degree of protection		IP23	IP44	IP23	IP23
Dimensions (with doors and panels)					
• Width	mm	1200	900	600	600
• Height	mm	2300	2200	2300	2300
• Depth	mm	600	1200	1200	600 (compact)
Weight	kg	550	1100	850	450

[1] Data without taking options into account.

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Technical specifications

Slipring excitation unit		6RN7011-0SJ42-0AA0	6RN7011-1SH42-0AA0	6RN7011-6SK42-2AA0
Rated DC current	A	1900	2000	2200
Supply voltage	V	830 V 3 AC	690 V 3 AC	950 V 3 AC
Voltage range	%	-20 ... +10	-20 ... +10	-20 ... +15
Rated supply frequency	Hz	50/60	50/60	50/60
Frequency range	Hz	45 ... 65	45 ... 65	45 ... 65
Power loss at rated current (SIMOTRAS HD)	kW	8.7	8.2	11.4
Electronics power supply		230 V 1 AC, 2 A	230 V 1 AC, 2 A	230 V 1 AC, 2 A
Fan power supply		400 V 3 AC, 50 Hz, 1.0 A 460 V 3 AC, 60 Hz, 1.25 A	400 V 3 AC, 50 Hz, 1.0 A 460 V 3 AC, 60 Hz, 1.25 A	400 V 3 AC, 50 Hz, 1.0 A 460 V 3 AC, 60 Hz, 1.25 A
Max. current demand of the auxiliary supply 230 V 1 AC, 50/60 Hz [1]	A	2.5	2.5	2.5
Max. current demand of the auxiliary supply 400 V 3 AC, 50/60 Hz	A	2	2	2
Cooling air flow rate	m^3/s	0.67	0.67	0.67
Sound pressure level L_{pA} (1 m)	dB	<87	<87	<87
Measuring surface level L_s (1 m)	dB	17	17	17
Cable cross-sections, line-side, max. connectable per phase	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
Cable cross-sections, motor-side, max. connectable per phase	mm^2 (DIN VDE)	6 × 240	6 × 240	6 × 240
	AWG/MCM (NEC, CEC)	6 × 500 MCM	6 × 500 MCM	6 × 500 MCM
PE connection, max. connection cross-section at enclosure with M12 screw	mm^2 (DIN VDE)	3 × 240	3 × 240	3 × 240
	AWG/MCM (NEC, CEC)	3 × 500 MCM	3 × 500 MCM	3 × 500 MCM
Degree of protection		IP23	IP23	IP23
Dimensions (with doors and panels)				
• Width	mm	600	600	600
• Height	mm	2300	2300	2300
• Depth	mm	1200	1200	1200
Weight	kg	900	900	900

[1] Data without taking options into account.

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Overview

The user-friendly STARTER commissioning tool can be used for:

- Commissioning
- Optimization
- Diagnostics

This software can be operated either as a standalone PC application, integrated in SIMATIC STEP 7 with TIA compatibility via Drive ES Basic, or it can be integrated into the SCOUT engineering system (for SIMOTION). The basic functions and handling are the same in both cases.

In STARTER, MICROMASTER 4 devices are also supported in addition to the SINAMICS drives.

The project wizards can be used to create the drives within the structure of the project tree.

Beginners are supported by solution-based dialog guidance, whereby a standard graphics-based display maximizes clarity when setting the drive parameters.

First commissioning is guided by a wizard which makes all the basic settings in the drive. Therefore, getting a motor up and running is merely a question of setting a few of the drive parameters as part of the drive configuration process.

The individual settings required are made using graphics-based parameterization screens, which also precisely visualize the principle of operation of the drive.

Examples of individual settings that can be made include:

- How terminals are used
- Bus interface
- Setpoint channel (e.g., fixed setpoints)
- Closed-loop speed control (e.g., ramp-function generator, limits)
- BICO interconnections
- Diagnostics

For experts, the expert list can be used to specifically and quickly access individual parameters at any time. An individual compilation of frequently used parameters can be saved in dedicated user lists and watch tables.

In addition, the following functions are available for optimization purposes:

- Self-optimization of the controller settings (depending on drive unit)
- Trace
  (depending on the drive unit, this is not supported for
  - MICROMASTER 4
  - SINAMICS G110
  - SINAMICS G120 < FW V4.4
  - SINAMICS G110D
  - SINAMICS G120D)

Diagnostics functions provide information about:

- Control/status words
- Parameter status
- Operating conditions
- Communication states

Performance features

- User-friendly: only a small number of settings need to be made for successful first commissioning: the motor starts to rotate
- Solution-oriented dialog-based user guidance simplifies commissioning
- Self-optimization functions reduce manual effort for optimization

Selection and ordering data

Description	Order No.
STARTER commissioning tool for SINAMICS and MICROMASTER DVD-ROM English, French, German, Italian, Spanish	**6SL3072-0AA00-0AG0**

More information

The STARTER commissioning tool is also available for update purposes on the Internet at www.siemens.com/starter

Note:

The SINAMICS SM150 converters are operated with the SIMOTION SCOUT engineering system. For more information, please refer to page 7/15 et seqq.

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Engineering software Drive ES

Overview

Drive ES is the engineering system used to integrate Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively in terms of communication, configuration and data management.

It is based on the operator interface of the STEP 7 Manager, the essential element when it comes to engineering.

Drive ES Basic

Drive ES Basic is for first-time users of the world of Totally Integrated Automation and the basic software for setting the parameters of all drives online and offline in this environment. Drive ES Basic enables both the automation system and the drives to be handled using the SIMATIC Manager software. Drive ES Basic is the starting point for common data archiving for complete projects and for extending the use of the SIMATIC teleservice to drives. Drive ES Basic provides the configuration tools for the new Motion Control functions – slave-to-slave communication, equidistance and isochronous operation with PROFIBUS DP and ensures that drives with PROFINET IO are simply integrated into the SIMATIC environment.

Selection and ordering data

Description	Order No.
Drive ES Basic V5.5 SPx *)	
Configuration software for the integration of drives into TIA (Totally Integrated Automation) Precondition: STEP 7 from V5.3, SP3 and higher	
Supplied as: DVD Languages: Eng, Fr, Ger, It, Sp with electronic documentation	
• Floating license, 1 user	**6SW1700-5JA00-5AA0**
• Floating license (copy license), 60 users	**6SW1700-5JA00-5AA1**
• Update service for single-user license	**6SW1700-0JA00-0AB2**
• Update service for copy license, 60 users	**6SW1700-0JA00-1AB2**
• Upgrade from V5.x to V5.5 SPx *)	**6SW1700-5JA00-5AA4**

More information

More information is available on the Internet at:
http://www.siemens.com/drivesolutions

* Orders are always automatically supplied with the latest SP.

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Overview

The SIMOTION SCOUT engineering system provides important new features in version V4.2 and higher. The focus is on an improved connection of the SINAMICS S120 drive system, the completion of the comparison functionality and many usability improvements.

Improved connection to SINAMICS S120

The most important innovation in the SIMOTION SCOUT engineering system is the significantly simplified connection to the SINAMICS S120 drive system. Drives and their components are integrated automatically to the greatest possible extent. The connections to the drive objects are simply interconnected, whereby the required message frame generation is performed automatically by the engineering system.

Uniform display of lists

The display of all lists in the system has now been simplified and adapted to the well-known look and feel of Office applications. The highest possible data security was observed during the implementation. If there are any operation faults (e.g. faulty copy and paste), the system restores the data. In this way, even beginners can become familiar with the engineering software, intuitively, quickly and safely.

System trace across several motion controllers

The so-called system trace feature is available for analysis or system optimization. This enables up to 128 signals from SIMOTION controllers networked via PROFINET to be recorded synchronously.

Trace for technology objects

With the new TO trace, all events affecting a technology object can be recorded in real-time and displayed in detail in a chronological sequence in the engineering system.

New watch tables

The new watch tables provide extended functions and diagnostic options. They allow different variables of the project (also different devices) to be collected. The watch tables can be clearly displayed and controlled with current values. Stored control value tables can also be used to perform comprehensive test sequences quickly and easily.

Easier to use during programming

Greater clarity is provided in the general programming through small additions such as the display of the variable type, display of the current value when there is an online connection and language-dependent comments which appear when the cursor is moved over the code ("tooltips").

Rollout tips provide the user with information on faulty entries or system information that is still missing when working in tables or entry fields. The system-wide effective automatic completion of user entries ("Auto-Complete") with automatic correction of upper/lower case makes the editing process more efficient and provides an easily readable program code.

Simple interconnection of the drive I/Os

Scope of supply

SIMOTION SCOUT engineering software

- SCOUT with corresponding license
- License key for SCOUT
- Integrated STARTER commissioning tool

Optional packages for SIMOTION SCOUT

- Optional Drive Control Chart (DCC) package without license
  The license must be ordered separately.

Documentation

- Complete SIMOTION documentation on DVD

Other software

- SIMOTION – Utilities & Applications
  Free utilities (e.g. calculation tools, optimization tools, etc.) and application examples (ready-to-apply solutions such as winders, cross cutters or handling) as well as the project generator SIMOTION easyProject
- SIMATIC NET without license
- DriveES Basic with license
- SIMATIC software:
  with SCOUT stand-alone, the necessary components of STEP 7

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SIMOTION SCOUT V4.2 software package

Overview

Integrated STARTER commissioning tool

The STARTER commissioning tool is directly integrated in SCOUT. It supports the simple and rapid commissioning, optimization and diagnostics of all new-generation Siemens drives with only one tool.

STARTER supports the drives:

- SINAMICS
- MICROMASTER 420/430/440
- MICROMASTER 411/COMBIMASTER 411
- COMBIMASTER

SIMOTION SCOUT stand-alone software package

If STEP 7 is not installed, the SIMOTION SCOUT stand-alone software package can be used. It also contains the components of STEP 7 that are required for SIMOTION SCOUT as well as the license key for SCOUT stand-alone. It is not possible to operate the SCOUT and SCOUT stand-alone software packages on the same machine.

SIMOTION Kernel updates

SIMOTION Kernel updates for all SIMOTION platforms are supplied on DVD and can then be copied from the PG/PC to the SIMOTION Micro Memory Card (C2xx) or SIMOTION Compact-Flash card (SIMOTION D) or installed on the P350-3.

A PC card adapter is needed to write to the SIMOTION MMC (Micro Memory Card) or the SIMOTION CF (CompactFlash card).

Adapters can usually be found in PC shops and at electronics shops.

Benefits

- Time saving and reduction of faulty entries through automatic generation of the PROFIdrive message frames by the engineering.
- Comparison function allows the simple comparison of programs. Existing programs can therefore be simply merged.
- Improved system and error diagnostics through numerous extensions for the test and diagnostic functions within the engineering environment.
- Quicker and simpler program creation through extended editor functions and easier-to-read programs through the retention of upper and lower cases in the system.

Selection and ordering data

Description	Order No.
SIMOTION SCOUT software package	
SIMOTION SCOUT V4.3 SP1 On DVD, including STARTER, runtime software and documentation Languages: English, French, German, Italian	
• Single license	**6AU1810-1BA43-1XA0**
• Upgrade	**6AU1810-1BA43-1XE0**
• Trial license	**6AU1810-1BA42-1XT7**
SIMOTION SCOUT V4.3 SP1 stand-alone On DVD, including STARTER, runtime software and documentation Languages: English, French, German, Italian	
• Single license	**6AU1810-1CA43-1XA0**
• Upgrade	**6AU1810-1CA43-1XE0**
• Trial license	**6AU1810-1CA42-1XT7**
Software update service The latest software version is necessary	
• for SIMOTION SCOUT	**6AU1810-0BA00-0XL0**
• for SIMOTION SCOUT stand-alone	**6AU1810-0CA00-0XL0**
Optional packages for SIMOTION SCOUT	
DCC SIMOTION/SINAMICS V2.2 SP1 for SCOUT V4.3 SP1/ STARTER V4.3 SP1 Graphic programming with Drive Control Chart DCC editor + DCB libraries for use on SIMOTION and SINAMICS S120	
• Single engineering license, with data carrier	**6AU1810-1JA22-1XA0**
• Upgrade, with data carrier	**6AU1810-1JA22-1XE0**

More information

A number of additional software products can be used in conjunction with SIMOTION SCOUT. It must be ensured that the corresponding versions of these software products are compatible. Please consult the "Compatibility table of the software products in the SIMOTION environment".

Additional information is available in the Internet under:
http://support.automation.siemens.com/WW/view/en/18857317

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Overview

Please observe the availability of the licenses for SIMOTION technology and communication functions for SINAMICS SM150 listed in the following.

Unlicensed basic functions

The rights of use for these software components are included when the basic unit is purchased:

- SIMOTION Kernel runtime software
  The SIMOTION Kernel is already installed on the unit.
- Motion Control Basic technology functions
  Use of technology functions for speed-controlled axes, single output cams and cam tracks, measuring inputs, and external encoders.
- Technology functions for Drive Control Chart
  By installing the optional SCOUT package Drive Control Chart, the technology functions of Drive Control Chart are made available to the SIMOTION runtime system.
- Supplementary technology functions
  Use of supplementary technology functions, such as adders, formula objects and fixed gears.
- Function libraries for I/O interfacing
- Communication functions
  This includes SIMATIC S7 communication functions on the SIMOTION side (programming device/OP communication to programming devices, for engineering and communication to TPs/OPs/MPs and PCs with SIMATIC HMI, e.g., ProTool/Pro, WinCC flexible or SIMATIC NET OPC), as well as UDP and TCP/IP communication

SIMOTION IT communication functions subject to license

SIMOTION IT enables additional communication functions via Industrial Ethernet (HTML through the Internet browser):

- Diagnostics functions via SIMOTION IT DIAG
- Communication via SIMOTION IT OPC XML DA
- SIMOTION IT Virtual Machine: Creation of Java applications for SIMOTION

Licenses for SIMOTION IT

One license is required for each SIMOTION device for the software options "SIMOTION IT DIAG", "SIMOTION IT OPC XML-DA" and the multiple license "SIMOTION IT".

How can licenses be obtained for runtime software?

Licenses for SIMOTION runtime software are ordered separately, independently of purchase of a SIMOTION controller or a SIMOTION memory card (CompactFlash card). The required software options are assigned to hardware (memory cards) by generating a license key over the Internet at:
www.siemens.com/automation/license

Selection and ordering data

Description	Order No.
CompactFlash Card (CF) 1 Gbyte for SINAMICS SM 150 with SIMOTION D455-2, including the SINAMICS drive software, current firmware version	**6AU1400-2PM22-0AA0**