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ADNOC GROUP PROJECTS AND ENGINEERING

CRITICALITY RATING SPECIFICATION

Specification

APPROVED BY:

A handwritten signature in blue ink, appearing to read 'Abdulmunim Al Kindy'.

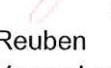
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GROUP PROJECTS & ENGINEERING FUNCTION/ PT&CS DIRECTORATE

CUSTODIAN ADNOC	Group Projects & Engineering / PT&CS Specification applicable to ADNOC & ADNOC Group Companies
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REVISION HISTORY

DATE	REV. NO	PREPARED BY (Designation / Initial)	REVIEWED BY (Designation / Initial)	ENDORSED BY (Designation / Initial)	ENDORSED BY (Designation / Initial)
15 Dec 2020	1	Aymen Helmy/Sr. Engineer Quality Control 	Ashwani Kumar Kataria/ A/MIHE  Digitally signed by Ashwani Kumar Kataria DN: cn=Ashwani Kumar Kataria, o=ADNOC Onshore, ou=ADNOC Onshore, email=a.kataria@adn oc.ae, c=AE Date: 2021.02.14 09:29:07 +04'00' Reuben Yagambaran/ SPM-GPE  Digitally signed by Reuben Yagambaran Date: 2021.02.14 13:15:45 +04'00'	Abdulla Al Shaiba/ VP-GPE  Digitally signed by Abdulla Al Shaiba Date: 2021.02.14 14:07:58 +04'00'	Zaher Salem/ SVP-GPE  Digitally signed by Zaher Salem DN: cn=Zaher.Salem, o=ADNOC, email=z.salem@adnoc.a e, c=AE Date: 2021.02.16 22:44:59 +04'00' Adobe Acrobat Reader version: 2020.013 20064

Group Projects & Engineering is the owner of this Specification and responsible for its custody, maintenance and periodic update.

In addition, Group Projects & Engineering is responsible for communication and distribution of any changes to this Specification and its version control.

This specification will be reviewed and updated in case of any changes affecting the activities described in this specification.

INTER-RELATIONSHIPS AND STAKEHOLDERS

- a. The following are inter-relationships for implementation of this Specification:
 - i. ADNOC Upstream and ADNOC Downstream Directorates; and
 - ii. ADNOC Onshore, ADNOC Offshore, ADNOC Sour Gas, ADNOC Gas Processing, ADNOC LNG, ADNOC Refining, ADNOC Fertilisers, Borouge, Al Dhafra Petroleum, Al Yasat
- b. The following are stakeholders for the purpose of this Specification:
 - i. ADNOC PT&CS Directorate
- c. This Specification has been approved by the ADNOC PT&CS is to be implemented by each ADNOC Group company included above subject to and in accordance with their Delegation of Authority and other governance-related processes in order to ensure compliance.
- d. Each ADNOC Group company must establish/nominate a Technical Authority responsible for compliance with this Specification.

DEFINITIONS

"ADNOC" means Abu Dhabi National Oil Company.

"ADNOC Group" means ADNOC together with each company in which ADNOC, directly or indirectly, controls fifty percent (50%) or more of the share capital.

"Approving Authority" means the decision-making body or employee with the required authority to approve Policies & Procedures or any changes to it.

"Business Line Directorates" or **"BLD"** means a directorate of ADNOC which is responsible for one or more Group Companies reporting to, or operating within the same line of business as, such directorate.

"Business Support Directorates and Functions" or **"Non- BLD"** means all the ADNOC functions and the remaining directorates, which are not ADNOC Business Line Directorates.

"CEO" means chief executive officer.

"Group Company" means any company within the ADNOC Group other than ADNOC.

"Specification" means this Criticality Rating Specification

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1 GENERAL

1.1 Introduction

Equipment and bulk materials that form part of a hydrocarbon-processing facility shall be assigned a Criticality Rating (CR). The CR has a numerical value between 1 and 4; a CR of 1 is the highest rating ('importance'), descending 2, 3 and 4 as the lowest criticality rating. The CR is used by the CONTRACTOR and COMPANY to:

- a. Define inspection requirements, test plans, and certification requirements to be applied to SUPPLIERS and MANUFACTURERS for that item, and the extent of documentation to be supplied by them;
- b. Manage the allocation of Quality resources by optimizing the specification, cross-checking, review and inspection on those items that are judged to be less critical and increasing these activities on the more critical items.
- c. Enable the Operation and Maintenance groups to prioritize work; use resources efficiently; and contribute to the COMPANY goals of safe and profitable operation. Operational routines; condition monitoring; protection systems; spare parts; and maintenance resources can be directed primarily at those assets that are most critical to the safety and efficient operation of the facility

Given the onward significance of the CR, it follows that assigning an appropriate CR value is of vital importance – over specification of the CR may result in unnecessary CAPEX and OPEX whereas under specification of the CR may result in costly down time or loss of integrity.

1.2 Purpose

This specification defines the calculation methods to be used to determine the CR of the many different commodities and components required to design and construct an industrial facility.

This specification also presents minimum pre-selected CR values. However, CONTRACTOR shall be responsible for developing the CR for any items that are not covered by this document, and for reassessing CR values as necessitated by changes in parameters during detailed design.

Note that this specification only addresses the techniques used to assign a CR value. The subsequent use of the CR value to define inspection and test requirements, and to determine the criticality ranking for equipment maintenance is excluded from the scope of this specification.

1.3 Definitions and Abbreviations

The following defined terms are used throughout this specification:

'[PSR]' indicates a mandatory Process Safety Requirement.

"COMPANY" means ADNOC, ADNOC Group or an ADNOC Group Company, and includes any agent or consultant authorized to act for, and on behalf of the COMPANY.

"CONTRACTOR" means the parties that carry out all or part of the design, engineering, procurement, construction, commissioning or management for ADNOC projects. CONTRACTOR includes its approved MANUFACTURER(s), SUPPLIER(s), SUB-SUPPLIER(s) and SUB-CONTRACTOR(s).

'MANUFACTURER' means the Original Equipment Manufacturer (OEM) or MANUFACTURER of one or more of the component(s) which make up a sub-assembly or item of equipment assembled by the main SUPPLIER or his nominated SUB-SUPPLIER.

'may' means a permitted option

'shall' indicates mandatory requirements

'should' means a recommendation

'SUB-CONTRACTOR' means any party engaged by the CONTRACTOR to undertake any assigned work on their behalf. COMPANY maintains the right to review all proposed SUB-CONTRACTORS; this right does not relieve the CONTRACTOR of their obligations under the Contract, nor does it create any contractual relationship between COMPANY and the SUB-CONTRACTOR.

'SUPPLIER' means the party entering into a Contract with COMPANY to provide the materials, equipment, supporting technical documents and/or drawings, guarantees, warranties and/or agreed services in accordance with the requirements of the purchase order and relevant specification(s). The term SUPPLIER includes any legally appointed successors and/or nominated representatives of the SUPPLIER.

'SUB-SUPPLIER' means the sub-contracted SUPPLIER of equipment sub-components software and/or support services relating to the equipment / package, or part thereof, to be provided by the SUPPLIER. COMPANY maintains the right to review all proposed SUB-SUPPLIERS, but this right does not relieve the SUPPLIER of their obligations under the Contract, nor does it create any contractual relationship between COMPANY and any individual SUB-SUPPLIER.

The abbreviations used throughout this specification are shown in Table 1.1.

Table 1.1 List of Abbreviations

Abbreviations	
ASNT	American Society for Non-destructive Testing
CAPEX	Capital Expenditure
CF	Calculation Factor
CL	Checking Level
Cl ₂	Chlorine
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CR	Criticality Rating
CRA	Corrosion Resistant Alloy
CS	Carbon Steel
ECMS	Electrical Control and Monitoring System
EPC	Engineering, Procurement, Construction
FEED	Front End Engineering and Design
H ₂	Hydrogen
H ₂ O	Water
H ₂ S	Hydrogen Sulphide
HC	Hydrocarbon
HFA	Hydrofluoric Acid
HIC	Hydrogen Induced Cracking
HRSG	Heat Recovery Steam Generator
HSECES	Health, Safety, Environment Critical Equipment and Systems
IPF	Instrumented Protective Function
ISO	International Organisation for Standardisation

Abbreviations	
ITP	Inspection Test Plan
LNG	Liquified Natural Gas
LTCS	Low Temperature Carbon Steel
MF	Material Factor
MW	Mega Watt
N ₂	Nitrogen
NDE	Non-destructive Examination
NH ₃	Ammonia
NPSH	Net Positive Suction Head
O ₂	Oxygen
OPEX	Operating Expenditure
PF	Process Factor
PID	Process and Instrumentation Diagram
PQR	Product Quality Record
PSC	Process Safety Category
QA / QC	Quality Assurance / Quality Control
RBI	Risk Based Inspection
RCM	Reliability Centred Maintenance
SDSS	Super Duplex Stainless Steel
SF	Stream Factor
SS	Stainless Steel
TD	Tissue Damage
TPI	Third Party Inspection
TSO	Total Shut-Off
VFD	Variable Frequency Drive
WPS	Welding Procedure Specification
WQR	Welder Qualification record

SECTION A - GENERAL

2 REFERENCE DOCUMENTS

2.1 International Codes and Standards

The following Codes and Standards shall form a part of this specification. When an edition date is not indicated for a Code or Standard, the latest edition in force at the time of the contract award shall apply.

AMERICAN PETROLEUM INSTITUTE (API)

API 588 Recommended Practice for Source Inspection and Quality Surveillance of Fixed Equipment

BRITISH STANDARDS INSTITUTION (BSI)

BS EN 10204 Recommended Practice, Personnel Qualification and Certification in Non-destructive Testing

INTERNATIONAL ORGANISATION FOR STANDARDISATION (ISO)

ISO 9001 Quality Management Systems –Requirements
ISO 9004 Managing for the Sustained Success of an Organization –A Quality Management Approach
ISO 19011 Guidelines for Auditing Management Systems
ISO 29001 Petroleum, petrochemical and natural gas industries — Sector-specific quality Management systems — Requirements for product and service supply organizations

2.2 ADNOC Specifications

HSE-OS-ST29 Health Safety Environment Management System HSECES Management Standard

2.3 Standard Drawings

None at present.

2.4 Other References

None at present.

3 DOCUMENT PRECEDENCE

The specifications and codes referred to in this specification shall, unless stated otherwise, be the latest approved issue at the time of contract award.

It shall be the CONTRACTOR's responsibility to be, or to become, knowledgeable of the requirements of the referenced Codes and Standards.

The CONTRACTOR shall notify the COMPANY of any apparent conflict between this specification, the related data sheets, the Codes and Standards and any other specifications noted herein.

Resolution and/or interpretation precedence shall be obtained from the COMPANY in writing before proceeding with the design/manufacture.

In case of conflict, the order of document precedence shall be:

- a. UAE Statutory requirements
- b. ADNOC Codes of Practice
- c. Equipment datasheets and drawings
- d. Project Specifications and standard drawings
- e. Company Specifications
- f. National / International Standards

4 SPECIFICATION DEVIATION / CONCESSION CONTROL

Any deviation / concession to the Specifications and its attachments including, but not limited to, the Data Sheets, Drawings and Narrative Specifications shall be sought by the CONTRACTOR, SUBCONTRACTOR, and MANUFACTURER only through concession / deviation request format. Deviations / concessions are requested by the CONTRACTOR either on their behalf or on behalf of their SUBCONTRACTOR(s) and / or MANUFACTURER(s), after receiving the award of the Contract or Purchase Order.

A Deviation/concession require COMPANY's review and approval prior to the implementation of the proposed changes. Changes implemented prior to COMPANY approval are liable to be rejected at COMPANY's sole discretion.

5 DESIGN CONSIDERATIONS / MINIMUM DESIGN REQUIREMENTS

Design considerations are included in Section B.

SECTION B – TECHNICAL REQUIREMENTS

6 PROCESS OVERVIEW

The Critical Rating shall be used to optimize inspection, quality and engineering resources:

- a. CR = 1: quality is vital and must not be compromised
- b. CR = 2: quality is of significant importance
- c. CR = 3: quality is of moderate importance
- d. CR = 4: normal commercial quality is acceptable

The calculation of CR starts by classifying each item as:

- a. A pressure containing component, or
- b. A non-pressure containing component.

In both cases, tables of pre-determined minimum required CR values for commonly encountered components are included in Appendix A1, which shall not be reduced (i.e. a lower criticality rating selected) unless agreed by COMPANY.

For pressure containing components, the CR is calculated as per the method described in Section 7.0.

For non-pressure containing components, the CR is determined as per the method described in Section 8.0

The FEED CONTRACTOR shall undertake the initial assessment of CR values during the 'define' (FEED) phase of a Project to ensure that the required design and purchasing requirements are included in the datasheets and specifications for all equipment items and bulk commodities procured and installed under a specific project. Starting the evaluation of the CR in an early phase of the Project ensures that the bidders list includes only qualified MANUFACTURERS and SUPPLIERS.

The EPC CONTRACTOR shall ensure that the final assessment of CR values is done during the 'execute' (EPC) phase of a Project and is maintained until handover and acceptance of the Project by COMPANY.

In all phases of the Project, the CONTRACTOR shall ensure that the CR assessment process is well-managed and documented in order to support the design and purchasing of equipment and bulk commodities. CONTRACTOR shall make the CR assessment process available to independent auditors if required by COMPANY.

7 CR CALCULATION FOR PRESSURE-CONTAINING COMPONENTS

The minimum required CR values for pressure-containing components shall be as listed in Appendix A1. The CONTRACTOR may reassess the quoted CR value using the method described in this section to calculate a new CR value [PSR]. The method described in this section may also be used for items not listed in Appendix A1.

The calculation of CR for pressure-containing components is a multiple-step process that requires determination of intermediate factors, such as Process Safety Category, Process Factor and Material Factor, as described in the following sub-sections.

7.1 Process Safety Category (PSC) Calculation

A PSC shall be determined for each service from the stream components as indicated in the Process Flow Diagrams, Heat and Material Balances, or other sources. Each stream shall be assessed for the following Stream Factors (SF):

- a. Flammability;
- b. Toxicity;
- c. Propensity to cause Human Tissue Damage; and
- d. Compressibility.

Each applicable Stream Factor is given a score of 1. The PSC is defined as:

PSC = 5 minus the sum of Stream Factors

Note: the lower the calculated PSC, the more critical the stream is

Stream Factors and the resulting PSC for common streams are given in Table 7.1. If additional Stream Factors are needed for Project-specific streams, they shall be developed by the CONTRACTOR, and submitted to the COMPANY for approval.

Table 7.1 Process Safety Category

Stream Properties		Stream Factors (Note 3)				PSC = (5- Σ SFs)	Notes
Service:	Phase:	Flammable	Toxic (Note 4)	Human Tissue Damage (Note 5)	Compressible		
Air	Vapour	0	0	0	1	4	
Amine (Lean) and similar solvents	Liquid	1	1	0	0	3	
Amine (Rich) and similar solvents with H ₂ S	Liquid	1	1	1	1	1	6
Cl ₂	Vapour	1	1	1	1	1	2
CO	Vapour	1	1	0	1	2	
CO ₂	Vapour	0	0	0	1	4	
H ₂	Vapour	1	0	0	1	3	
H ₂ O	Liquid	0	0	0	0	5	
H ₂ O (Sour)	Liquid	1	1	1	0	2	
H ₂ S	Vapour	1	1	1	1	1	
HC	Vapour	1	0	0	1	3	3
HC (Heavy)	Liquid	1	0	0	0	4	1, 3
HC (Light)	Liquid	1	0	0	1	3	1, 3, 6
HFA	Liquid	0	1	1	1	2	6
N ₂	Vapour	0	0	0	1	4	
NH ₃	Vapour	1	1	1	1	1	
O ₂	Vapour	1*	0	0	1	3	2
Steam	Vapour	0	0	0	1	4	
Refining Chemicals	Liquid						7

Notes:

1. LNG and LPG (C_1 , C_2 , C_3 and C_4) are considered as light hydrocarbons; C_{5+} are considered as heavy hydrocarbons.
2. Oxygen and chlorine are not flammable but support combustion.
3. In multi-component streams, if any component generates a value of "1" for a Stream Factor, that "1" shall be used for the composite stream.
4. Stream components that are less than 1 mol% in the vapor phase on atmospheric flash* do not need to be considered. When the vapour phase concentration of H_2S , hydrofluoric acid, chlorine, carbon monoxide or ammonia contents exceed this criterion, the stream shall be considered toxic for the purposes calculating CR.
5. *) When flashed adiabatically from normal operating temperature and pressure to atmospheric pressure. No credit shall be taken for subsequent warming or cooling.
6. Examples of streams considered to cause Human Tissue Damage (TD) are most acids and caustics. Streams that would cause burns due to high or low (cryogenic) temperature should not receive a "1" in this category, as temperature is considered within the Process Factor (refer Section 7.2).
7. Liquid Streams shall be considered compressible for the purpose of this calculation if they generate a flammable or toxic vapor cloud on release or flash to the atmosphere. An example is light hydrocarbon liquids (Light HC).
8. Refining Chemicals shall be assessed by CONTRACTOR on a project by project basis.

7.2 Process Factor (PF) Calculation

An overall Process Factor (PF) shall be determined for each service from the PSC, design pressure and design temperature according to the following steps:

- a. Determine a Pressure Factor (P) using Table 7.2;
- b. Determine a Temperature Factor (T) using Table 7.3;
- c. Use the Process Safety Category from Section 7.1 and P and T (steps a. and b. respectively) to determine a Calculation Factor (CF) using Table 7.4; and
- d. Derive the Process Factor (PF) from the CF using Table 7.5.

Table 7.2 Pressure Factor

Design Press. (barg)	Pressure Factor (P)
£ 1	4
1 - 42	3
43 - 63	2
≥ 64	1

Notes:

1. Lower design pressure, i.e. full and partial vacuum, is not considered in the Pressure Factor

Table 7.3 Temperature Factor

Design Temp. (°C)	Temperature Factor (T)
< 0 (Note 1)	1
0 - 185	4
186 - 260	3
261 - 427	2
≥ 428	1

Notes:

1. Use T = 1 if Lower Design Temperature is less than 0 °C

Table 7.4 Calculation Factor

PSC (from Section 7.1)	Calculation Factor (CF)
5	P x T x 100
4	P x T x 50
3	P x T x 25
2	P x T x 5
1	P x T x 1

Table 7.5 Process Factor

CF	Process Factor (PF)
≥500	4
100-499	3
10-99	2
£9	1

7.3 Calculation of Criticality Rating

Criticality Rating (CR) shall be determined from the PF (determined in Section 7.2) and Material Factor (MF). The following equations shall be used:

$$\begin{aligned} \text{If } PF = 1, & \quad \text{then } CR = 1 \\ \text{If } PF = 2, 3 \text{ or } 4, & \quad \text{then } CR = (PF - MF) \end{aligned}$$

The following MF shall be used for the following pressure boundary materials:

- a. The MF shall equal 1 when:
 - i. Material is alloy, alloy-lined or non-metallic lined. Alloy materials shall include non-ferrous metals e.g.. titanium and stainless steel (all grades);
 - ii. Material is low temperature carbon steel (i.e. impact tested);
 - iii. Material is Hydrogen Induced Cracking (HIC) resistant carbon steel; or
 - iv. Material welds are stress relieved for process reasons.
- b. The MF shall equal 0 for cast iron and carbon steel
- c. For material of construction not listed in a. or b., the MF shall equal 1.

Note that the MF cannot be greater than 1

For equipment handling several process streams (e.g. shellside and tubeside of heat exchangers), the lowest PF value governs for that equipment.

7.4 Other Considerations

In addition to the analytical method outlined in Section 7.3, CONTRACTOR may consider (particularly for rotating equipment items and packages) the following qualitative factors when determining the CR of an item:

- a. Design Maturity - considers the availability of established design information, what percentage is already known and proven from tests or experience with similar equipment. Commercial availability and the capabilities of prospective SUPPLIERS and MANUFACTURERS should also be considered.
- b. Design Complexity – considers the difficulty of completing the design; the number of man hours that are needed; the amount of specialist input involved; how much interface will be necessary between disciplines; and whether any literature surveys / research will be required.
- c. Health, Safety, Environment Critical factors - both product and service safety need to be considered in terms of the probability of failure occurring and the consequences of that failure. The safety and environmental impact of failure should be considered both for operating personnel and the public. This criterion may be subject to separate Quantitative Risk Assessment, HAZOP studies and other HSE studies.

Note: Items deemed HSE critical shall be CR = 1 by default. This includes firewater pumps, jockey pumps, safety-related instrumentation and other safety components listed in Appendix A1 [PSR].

- d. Manufacturing Complexity - considers the difficulty of manufacture; the number of different and possibly specialized processes involved; the number and coordination of disciplines required; and the verification of each stage during manufacture.
- e. Economics - addresses the difficulties that would be created and the loss of revenue that would occur in the event of the plant or item of equipment unavailable (failure or unplanned repairs).
- f. Construction / Installation - considers the difficulty of installation of equipment including any special lifting and movement requirements and the disruption to operations that would be caused if there was a need to shut down existing processes to allow installation.

7.5 Selected Criticality Rating

For most pressure containing components (particularly static equipment, pipe and pipe fittings etc), the CR as calculated in the preceding sections will be the selected CR value.

The CONTRACTOR may propose adjustments to lower the CR rating (i.e. select a higher value) and shall submit a written justification for COMPANY's approval. No decrease in CR shall be implemented without COMPANY's express approval in accordance with Section 4.0.

In particular, the CONTRACTOR may adjust the calculated CR to a higher rating (i.e. a lower value) based on the other considerations described in Section 7.4. The CONTRACTOR shall develop a procedure to demonstrate how these other consideration are included in the CR assessment. A suitable procedure may, for example, require the Project Engineering Manager to convene a combined CONTRACTOR / COMPANY workshop consisting of representatives from process, equipment, commissioning, operations and inspection. The additional factors shall be assessed (using a semi-quantitative scoring method if necessary) and the calculated CR adjusted as required

Any requirements given within project specifications that are based on the CR, shall be considered minimum requirements, and may be increased wherever appropriate. The final requirements shall be given on the data sheets and drawings.

The fabrication and assembly of vessels, piping, etc. with bolting, gaskets, welding, etc. will use the CR determined by the calculation method given in this section.

Items deemed HSE critical shall be CR = 1 by default [PSR]. This includes firewater pumps, jockey pumps, safety-related instrumentation and other safety components listed in Appendix A1

7.6 Calculation Examples

The following sections describe examples of CR calculation for selected pressure containing equipment items.

7.6.1 Mechanical Static Equipment – Pressure Vessel

The following example is to determine the CR for a Regenerator Column with a carbon steel shell and stainless steel internals in Rich Amine/H₂S service; design pressure is 3.5 bara and upper / lower, design temperature is 155 / 4 °C.

- a. Determine a Pressure Factor (P) using Table 7.2;

$$P = 3$$

- b. Determine a Temperature Factor (T) using Table 7.3;

$$T = 4$$

- c. Determine the Process Safety Category from Table 7.1

$$PSC = 1 \text{ (rich amine containing H}_2\text{S)}$$

- d. Use PSC, P and T to determine a Calculation Factor (CF) using Table 7.4;

$$PSC = 1, \text{ therefore } CF = P \times T \times 1$$

$$\text{therefore } CF = 3 \times 4 \times 1$$

$$CF = 12$$

- e. The Process Factor is derived from the CF using Table 7.5:

$$CF = 12, \text{ therefore PF} = 2.$$

- f. With the PF calculated, the MF needs to be considered prior to calculating the CR:

This item of equipment is carbon steel, which from Section 7.3 indicates MF = 0.

$$\text{Therefore CR} = 2$$

- g. When comparing this to the Tables for Static Equipment included in Appendix A1, this aligns with line item A1.3 (1) for Pressure Vessels which shows a CR of 2. From Section 7.4 no further adjustments are considered necessary and it is recommended that the selected CR is as calculated.

7.6.2 Mechanical - Rotating Equipment – Firewater Pump

The following example is to determine the CR for a Firewater Pump with stainless steel casing and impeller in water service. Design pressure 20 barg, design temperature 50 / -8 °C (upper / lower design temperature).

- a. Determine a Pressure Factor (P) using Table 7.2:

$$P = 3$$

- b. Determine a Temperature Factor (T) using Table 7.3:

$$T = 1 \text{ since Lower Design temperature is less than } 0 \text{ }^{\circ}\text{C}$$

- c. Determine the Process Safety Category from Table 7.1:

PSC = 5 (water service)

- d. Use PSC, P and T to determine a Calculation Factor (CF) using Table 7.4:

PSC = 5, therefore CF = $P \times T \times 100$

CF = $3 \times 1 \times 100$

CF = 300

- e. The Process Factor (PF) is derived from the CF using Table 7.5:

CF = 300, PF = 3

- f. With the PF calculated, the MF needs to be considered prior to calculating the CR:

MF = 1 as the casing is SS alloy

CR = PF – MF = 3 - 1

CR = 2

- g. A firewater pump is a Health, Safety, Environment Critical Equipment and System (HSECES) item and therefore shall have a CR = 1.

7.6.3 Mechanical - Rotating Equipment – Syngas Compressor

The following example is to determine the CR for a large steam turbine driven syngas compressor with a carbon steel casing and a discharge pressure of 64 barg; maximum discharge temperature is 150 °C.

- a. Determine a Pressure Factor (P) using Table 7.2:

P = 1

- b. Determine a Temperature Factor (T) using Table 7.3:

T = 4

- c. Determine the Process Safety Category from Table 7.1:

PSC = 2 (syngas is a 2:1 mixture of H₂ and CO, the PSC of H₂ is 3 and the PSC for CO is 2, therefore the lowest value is selected.)

- d. Use PSC, P and T to determine a Calculation Factor (CF) using Table 7.4:

PSC = 2, therefore CF = $P \times T \times 5$

CF = $1 \times 4 \times 5$

CF = 20

- e. The Process Factor (PF) is derived from the CF using Table 7.5:

CF = 20, PF = 2

- f. With the PF calculated, the MF needs to be considered prior to calculating the CR:

MF = 0 as the casing is CS

CR = PF – MF = 2 - 0

CR = 2

- g. Strict adherence to the CR calculation method would therefore return a CR = 2. However, given the type and function of the equipment being assessed, it is recommended that the qualitative factors described in Section 7.4 are reviewed to verify that CR = 2 is appropriate for such a large and bespoke compressor

(30+ MW shaft power). This review would almost certainly determine that the compressor is complex to design and manufacture and is production critical. The recommendation would therefore be to select a CR of 1.

8 DETERMINATION OF CR FOR NON-PRESSURE-CONTAINING COMPONENTS

Criticality Ratings for non-pressure containing structures, systems, bulk materials and components shall be as given in Appendix A1. For any procured item not included in Appendix A1, CONTRACTOR shall define a CR value and submit to COMPANY for approval.

9 INSPECTION REQUIREMENTS AND MATERIAL CERTIFICATION

The requirements for inspection and material certification are not detailed in this specification and reference should be made to the individual ADNOC Business Unit specifications. This section is merely to present an introduction to the topic and show how the selected CR drives the required inspection rating and material certification.

The minimum inspection requirements shall be derived from the Criticality Rating System for equipment and materials,

The minimum inspection requirements are assigned an "Inspection Class" of 1 through 4, which is directly related to that of the Criticality Rating 1 through 4, i.e. a CR of 1 will require a minimum inspection class of 1, a CR of 2 will require a minimum inspection class of 2, etc. An overview of this is included in Table 9.1.

CONTRACTOR may, at his discretion, increase or decrease the class of inspection over that determined as minimum based on previous selected supplier performance, experience, or documented and auditable feed-back system; however, any proposal to decrease the level based on supplier performance/experience shall be subject to prior COMPANY approval.

For material certification, CR 1 doesn't necessarily mean 3.2 certification as per EN 10204 but more quality intervention. Material certification for components (3.2 / 3.1 / 2.2 etc.) shall be followed as defined in respective individual ADNOC Business Unit specifications for various components. Where these are not defined in COMPANY standards, these shall be identified in the define (FEED) phase of Project and approved by COMPANY.

Inspection Test Plans shall be finalized during bidding to avoid conflicts during execution.

Table 9.1 Minimum Inspection Requirements - Inspection Classes

Minimum Inspection Requirements (Note 1)	Inspection Class			
	1	2	3	4
Attend Formal Pre-inspection Meeting	X			
Informal Pre-inspection Meeting	X	X	X	
Inspect raw material and review related documentation including certification	X	X		
Review and endorse all Drawings and Design calculations where applicable	X			
Inspect prefabrication - layout, cutting, forming, machining and other preparations	X			
Inspect fit up, alignment, and assembly	X	X		
Review & Verify WPS / PQR / WQR,	X			
Review NDE operators' qualifications to ASNT Level 2	X			

Minimum Inspection Requirements (Note 1)	Inspection Class			
	1	2	3	4
Review and Witness NDE procedures, welding and any other special processes	X	X		
Review Radiographic films and provide Interpretations	X			
Inspect internal cleaning	X	X		
Perform in-process checks for size, location, orientation and configuration	X	Note 2		
Witness acceptance testing (hydro, performance, NPSH, etc.)	X	X	Note 5	
Perform final dimensional checks for size, location, orientation and configuration	X	X	X	
Perform final visual check	X	X	X	
Examine paint/coating preparation and final surface condition	X	X	Note 3	
Inspect painting, tagging and prep for shipment	X	X	X	
Review QC documentation package - including concession requests	X	X	X	Note 4
Review and Endorse final ITP, all quality activities and test certificates.	X			

Notes:

1. Any reduction from full (100 %) inspection shall be subject to previous written approval by COMPANY.
2. Perform in-process inspection only as needed
3. Minimum requirement is to examine paint / coating final surface condition only.
4. Review test reports and data as required by Purchase Order
5. Review-only acceptance testing (hydro, performance, NPSH, etc.). However, the EPC CONTRACTOR discipline engineer may require witness of testing if specifically identified.

10 DOCUMENTATION

Spreadsheets showing the input process data, PSC, P, T, CF, PF, material of construction, MF and CR for each stream number shall be prepared and submitted to COMPANY as stand-alone documents by the CONTRACTOR during the FEED phase. A minimum of one spreadsheet shall be prepared per unit. The spreadsheet shall also list any arbitrary changes to the stream CR with the documentation of the reasons for the changes either attached or referenced. Changes of the CR of individual items within a stream shall be handled in accordance with Section 7.5 of this Specification. A sample spreadsheet is shown in Appendix A2.

The FEED CONTRACTOR shall undertake the initial assessment of CR values during the 'define' (FEED) phase of a Project and shall maintain the CR documentation and keep it up to date. Any facility additions and/or deletions within a unit shall be reflected in updated CR spreadsheets.

The EPC CONTRACTOR shall ensure that the final assessment of CR values is done during 'execute' (EPC) phase of a Project, captured and maintained in the relevant CR documentation until handover and acceptance of the Project by COMPANY. CR for pressure-containing piping / Pipeline components shall be recorded on the applicable line list. For any instruments, valves or other piping components for which a data sheet is prepared, the CR shall be listed on the data sheet.

CR for pressure-containing, mechanical equipment shall be recorded on the equipment lists and equipment data sheets.

CR for non-pressure-containing components and other items or components shall be determined by the responsible engineer and documented on the appropriate data sheets or purchase order documents.

For items with multiple components, if the components have separate data sheets, the components shall be assigned separate CR ratings. This particularly applies to complex units supplied as a package, and the MANUFACTURER and CONTRACTOR shall jointly establish CR for each piece of equipment for which a data sheet is developed. Other cases shall be addressed by CONTRACTOR on a case-by-case basis, and proposed CRs shall be submitted to COMPANY for approval.

11 CHECKING LEVEL (CL) REQUIREMENTS

The CONTRACTOR shall prepare a procedure for the checking of engineering documents. The engineering check procedure shall define design checking level requirements based on an item's Criticality Rating.

The engineering check procedure shall include as a minimum:

- a. Lists of design tasks (i.e. specific calculations) and documentation (i.e. drawings, data sheets and specifications) covered by the checking level guidelines
- b. If checklist forms are not developed, requirements of who shall prepare checklists for each type of item and/or task
- c. Level of Personnel required for preparation, checking and approving of documents for each CR, including cases where self-checks are acceptable
- d. For each type of item, requirements on whether individual checklists will be completed for each document or whether signature on the original document and subsequent revisions will be considered as evidence that the checking procedure has been followed
- e. Requirements on whether detailed checking or spot checking is required for each CR
- f. For each type of item, requirements on the percentage of documents to be checked for each CR
- g. Time period for retention of checklists; and
- h. Checklist requirements for revisions based on CR.

The Checking Level requirements based on CR shall be considered minimum requirements and shall be increased whenever deemed appropriate by CONTRACTOR.

All Checklist procedures shall be submitted to COMPANY for approval before use.

12 QUALITY PROGRAM

The critically rating results made by the above-mentioned procedure shall relate to the level of quality verification and quality control to be applied during design, procurement and construction activities.

The actual quality program requirements for each type of equipment such as Rotating Equipment, Pressure Vessel, Bulk Materials, etc., should be specified by CONTRACTOR and be reflected in the:

- a. Design verification activities,
- b. Preparation of requisitions for each item of equipment and material,
- c. Review of all inspection and test plans specified by MANUFACTURER,
- d. Surveillance of fabrication/manufacturing, and

e. Construction verification.

12.1 Design Audit

COMPANY reserves the right to audit the QA/QC, design, and manufacturing of any part of the equipment/package on order placed by CONTRACTOR to MANUFACTURERS, using its own expertise or a third party specialist/consultant employed for the purpose. CONTRACTOR is responsible to seek and provide the services of such a third party specialist/consultant who is acceptable to COMPANY.

Usually such an audit will be limited to major rotating equipment (process compressors, multi-stage pumps, turbo expanders, boilers, HRSG and/or equipment above 1 MW rating, and/or Criticality Rating 1 (CR 1) equipment). Audit of packaged units (if any) is mandatory. The timing of such an audit will be at the time when MANUFACTURER is ready with aerodynamic and rotor dynamic design of the equipment on order including piping and instrumentation diagrams (PIDs) and preliminary general arrangement drawings.

MANUFACTURER shall release to such an audit all the necessary in-house drawings, data, studies, analyses, and as a minimum, information the auditors require to complete their task.

SECTION C – NON-TECHNICAL REQUIREMENTS

13 QUALITY CONTROL AND ASSURANCE

Quality Management Systems shall comply with the applicable requirements of ISO 9001 and ISO 9004 with due regard to ISO 19011. The CONTRACTOR shall ensure that the MANUFACTURER shall have in effect at all times, a QA programme, which clearly establishes the authority and responsibilities of those responsible for the quality system. Persons performing quality functions shall have sufficient and well-defined authority to enforce quality requirements that they initiate or identify and to recommend and provide solutions for quality problems and thereafter verify the effectiveness of the corrective action.

Quality System and Quality Control requirements shall be identified and included in the CONTRACTOR's Purchase and Subcontracting DOCUMENT(s). Based on these requirements the MANUFACTURER & SUBCONTRACTOR shall develop a QA/QC programme which shall be submitted to the CONTRACTOR for review and approval. The MANUFACTURER's QA/QC programme shall extend to his SUB-MANUFACTURERS.

COMPANY/CONTRACTOR reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests.

The Criticality Rating (CR) System outlined in this General Specification shall be used by CONTRACTOR or CONTRACTOR's designee to develop the design checking levels and minimum requirements for shop inspection, testing and material certification.



SECTION D – STANDARD DRAWINGS & DATASHEETS

This section is not used as there are no associated standard drawing or datasheets.

SECTION E - APPENDICES

APPENDIX A1. MINIMUM CRITICALITY RATINGS

A1.1. Piping

Table A1. 1 Piping: Minimum Criticality Ratings

A1.1 Piping		Minimum Criticality Rating
#	Equipment / Item Description	
1	Manual Valves	1
	a. All services: 600# and above for all sizes; 300# 18' and above	
	b. Critical Service (Sour/Cryogenic/Amine/Steam) CS / LTCS \geq 6" and / or \geq 150#	
	c. CRA valves Critical service (Sour /Cryogenic): all sizes	
	d. CRA Non sour (e.g. Chemical injection, Utility, etc) for sizes $>$ 4"	
	e. Valves for TSO, Hot Tap, stoppling: all sizes and ratings	
f.	Valves in Cyclic Service: all sizes and ratings	
2	Manual Valves: other rating & sizes not covered in (1) above	2
3	Seamless Pipe (CS, LTCS & SS) - Non sour	2
3.1	Seamless Pipe (CS, LTCS & SS) - Sour & Severe Service	1
4	Seamless Pipe in CRA other than SS (i.e. SDSS, Ni alloy, alloy steel, Monel, etc.)	1
5	Cladded Pipes / Fittings / Flanges	1
6	Welded Pipe (CS, LTCS & SS)- Non sour	2
6.1	Welded Pipe (CS, LTCS & SS)- Sour & Severe Service	1
6.2	Welded Pipe (CS, LTCS & SS) Cyclic Service	1
7	CRA Welded Pipe other than SS (e.g. SDSS, DSS, Ni alloy ...etc.)	1
8	Fittings & Flanges (CS LTCS & SS)- Non sour	2
8.1	Fittings & Flanges (CS LTCS & SS)- Sour & Severe Service	1
8.2	Fittings & Flanges (CS LTCS & SS)- Cyclic Service	1
9	CRA Fitting & Flanges other than SS (e.g. DSS, SDSS, Ni alloy, etc.)	1
10	GRE, GRVE & HDPE Pipes, Flanges & Fittings (all Non-metal material)	1
11	Flame Arrestors	2
12	Insulating Gaskets / Kits	2
13	Gaskets (metallic)	2
14	Gaskets (non-metallic)	3
15	Fasteners	2

A1.1 Piping		
#	Equipment / Item Description	Minimum Criticality Rating
16	Mechanical Valve Interlocking System	2
17	Hub Connectors	1
18	Strainers	2
19	Chemical Injection Quill	2
20	Hose & Hose Couplings	3
21	Pipe Support Material (Spring Supports)	3
22	Pipe Support Material (Sliding Plate)	3
23	Pipe Support Material (Rolled Sections)	3

A1.2. Pipeline

Table A1. 2 Pipeline Minimum Criticality Ratings

A1.2 Pipeline		
#	Equipment / Item Description	Minimum Criticality Rating
1	Welded Line Pipe (SAW)	1
2	Seamless Line pipe (CS, all sizes)	1
3	High Frequency Electric Welded (HFW) Line Pipe	1
4	CRA MLP and Metallurgical bond Internal Lined Pipes	1
5	Non-Metallic Line Pipe (GRE, HDPE & RTP)	1
6	Barred Tee (Body & Bars)	1
7	Coatings (3LPP, 3LPE, FBE, Shrink sleeves, etc.) of Line pipes, Bends, & Fittings External & Internal.	1
8	Pipeline Field Joint Coating HSS Sleeves	1
9	All Flanges and Fittings	1
10	Pipeline Induction Bend	1
11	Pipeline Isolating / Insulating Joints (IJ)	1
12	Pipeline Pig Signaller	2
13	Pipeline Positive Seal Coupling Groove Coupling	1
14	Pipeline Valves	1
15	Pipeline Pig Traps (Receivers & Launchers) & End Enclosures	1
16	Hot Tap Split Tees, Sandwich Valve and Plugs	1
17	Pipeline Anchor Flanges	1
18	Welding Consumables	3

A1.3. Static Equipment

Table A1. 3 Static Equipment Minimum Criticality Ratings

A1.3 Static Equipment		
#	Equipment / Item Description	Minimum Criticality Rating
1	Pressure vessels (including all Vessels, Filters, Columns), Heat exchangers, Air coolers fabricated from carbon steel	2
2	Pressure vessels (Including all Vessels, Filters, Columns, Air coolers, Heat exchangers) – SS and CRA	1
3	Column Internals	2
4	Separator: - Production - Test	1
5	Separator Internals	2
6	Slug Catchers	1
7	Vessel Internals	2
8	Scrubber	1
9	Tanks (Shop & Field Fabricated)	2
10	Cryogenic Tanks	1
11	Spheres	1
12	Pressure vessels - Cladded	1

Notes:

1. National Board registration requirement has been defined in the relevant ADNOC Specification

A1.4. Rotating Equipment

Table A1. 4 Rotating Equipment Minimum Criticality Ratings

A1.4 Rotating Equipment		
#	Equipment / Item Description	Minimum Criticality Rating
1	Centrifugal Pumps – production and process critical	1
2	Centrifugal Pumps - utility applications, production and process non-critical.	2
3	Fire Water Pumps and Fire Water Jockey Pumps.	1
4	Pumps - Reciprocating and Rotary Positive Displacement	2
5	Centrifugal Compressors, Expanders, Rotary Positive Displacement Compressors, Reciprocating Compressor Packages handling Hydrocarbon gases including CO2, N2 and auxiliaries	1
6	Centrifugal, Screw, Reciprocating Compressors in utility, air service and air dryer packages	2
7	Turbine (Steam, Gas)	1
8	Emergency Diesel Generator Packages	1
9	Power Generation - STG / GTG	1

A1.5. Equipment Packages

Table A1. 5 Packaged Equipment Minimum Criticality Ratings

A1.5 Equipment Packages		
#	Equipment / Item Description	Minimum Criticality Rating (Note 2)
1	Flare Package (HP and / or Cold)	2
2	Flare Package (LP)	2
3	De-Salter Package	1
4	Gas Dehydration Package, Glycol Regeneration (or injection), Chlorination Package	2
5	Fired Heaters	1
6	Storage Tanks - GRP	2
7	Boiler Package	1
8	Reaction furnace	2
9	Incinerators	1
10	Nitrogen Bottle Rack Package	2
11	Refrigeration Units	2
12	Waste Heat Recovery Units (WHRUs)	1
13	Water Treatment Packages	2
14	Nitrogen Generation Package (Membrane, Pressure Swing Adsorption (PSA) or Air Separation Units (ASUs))	2
15	Chemical Injection Packages	2
16	Electric or Hand operated Overhead Travelling (EOT / HOT) Cranes, Hoists (Manual, electrical), Gantry cranes etc.	3
17	Solid Handling Equipment for Sulphur granules.	Note 1
18	Loading Arms for products (handling, HC)	1
19	Process and Utility Refrigeration Packages (water / glycol mixture cooling for process applications, VFD cooling etc.)	2
20	Chillers & Air Handling Units (AHU), DX Units (HVAC items). CR = 2 or 3 based on complexity	3

Notes:

1. To be decided based on production criticality of that component
2. If a package component has a higher criticality rating, then the higher value shall be used for that component.

A1.6. Instrumentation

Table A1. 6 Instrumentation Minimum Criticality Ratings

A1.6 Instrumentation		
#	Equipment / Item Description	Minimum Criticality Rating
1	Choke Valves	1
	Emergency Shutdown Valves (ESDV), HIPPS & EDPs	
	Surface Safety Valve	
2	Motor/ Remote Operated & ON / OFF Valves	1
	Manual Valves Retrofitted with Electric Actuators	
	Control Valves	
	V-type Actuated Valves	
3	Pressure Relief Valves / Safety Valves & Rupture discs/ Safety Relief Devices	1
4	Analyzer System	2
5	Fiscal Metering (Custody Transfer Instrumentation)	2
6	Integrated Control & Safety System (ICSS) Cabinets and other package control system.	1
	ICSS- DCS	
	ICSS- ESD	
	ICSS- F&G	
	ICSS- RTU & PLC	
7	Well Head Control Panel (WHCP)	2
	Well Head Hydraulic Panel (WHHP)	
8	High Integrity Pressure Protection System (HIPPS) Equipment	1
9	Control Panel (Not covered above)	2
10	ECMS system	2
11	Hydraulic Panel	2
12	Cause & Effect Matrices (Process, ESD, SIS and F&G system), SIL Report, SRS and F&G mapping report	1
13	DCS Configuration	1
14	Turbine Control System / Tank Gauging System / Custody Transfer Metering / Package Unit PLC / Machine Monitoring system - Hardware Configuration	1
15	Electronic Transmitter (SMART & FF) & Loop Powered Indicator Level Transmitters (Interface /Radar)	3
16	Multi-Phase Flow Meters Coriolis Mass Flow Meter Elector-Magnetic Flow Meters	2

A1.6 Instrumentation		
#	Equipment / Item Description	Minimum Criticality Rating
17	Turbine Flow Meter Ultrasonic Flow Meter V-Cone Flow Meter Rotameter & Purge Assembly	2
18	Gas Chromatograph	2
19	Self-Acting Regulators	3
20	Hydraulic Package Unit	2
21	FND Field BUS / Barrier Junction Boxes & Connectors	2
22	Condition & Vibration Monitoring System	2
23	Flow Orifice Assembly / Plate & Restriction Orifice / Plate	2
24	Averaging Pitot Tubes (Annubars)	3
25	Venturi Meters	2
26	Instrument Cables	3
27	Fire & Gas Detectors	1
28	Fire & Gas Detectors (Acoustic Leak Detectors)	1
29	Control Valve Retrofitted with new FF Positioner	3
30	Tubes (SS, Ni alloys ...etc.)	3
31	Tube Fittings	3
32	Air Distribution & other Manifolds	3
33	Drip Rings	3
34	Emergency Shutdown Push button	2
35	Unistrut	3
36	Tube Clamps	3
37	Multi-cable Transit	4
38	Cable Tray	3
39	Cable Gland	2
40	Fibre Optic cables	2
41	Multiport Selector Manifold	1
42	Metering Skid	2
43	Passive Cooling Shelter	2
44	New ECMS/ Existing ECMS System Modification	1
45	Pressure Gauges & Differential Pressure Gauges	3
46	Temperature Gauges	3
47	Temperature Elements / Thermowells	3
48	Level Gauges- Transparent /Glass	3

A1.6 Instrumentation		
#	Equipment / Item Description	Minimum Criticality Rating
49	Level Gauges- Magnetic	3
50	Multipoint Thermocouples & Resistance Temperature Detectors (RTDs)	3
51	Displacer /Radar LVL TXS	3
52	High Sensitivity Smoke Detection (HSSD)	1
53	Dissolved Gas Analysis Monitors	3
54	Instrument Sunshades	4
55	All IPF instrumentation	1

A1.7. Electrical

Table A1. 7 Electrical Minimum Criticality Ratings

A1.7 Electrical		
#	Equipment / Item Description	Minimum Criticality Rating
1	Power Transformer - 105 MVA and above	1
2	Distribution Transformers /	2
	Phase Shift Transformer	
3	Process Electric Heater	2
4	33KV Switchgear	2
5	33KV Switchgear Modification	2
6	132KV Switch Gear Modification	2
7	132KV GIS Switchgear	1
8	11KV & 3.3KV Switchgear	2
	11KV Ring Main Unit	
9	415V /LV Switchgear	2
	LV Switchgear Modification	
10	33KV Switch Board	2
11	11KV Switch Board	2
12	Harmonic Filters and Power Factor Equipment	2
	33Kv - 2.5 MVAR Capacitor Banks & Harmonic Filter	
13	415V Main Distribution Boards	2
	LV Distribution Board	
14	Online Condition Monitoring System (OLCMS-T and OLCMS-M)	2
15	UPS (AC, DC, & AC-DC) with Batteries	1
16	Substation Control & Monitoring System (SCMS)	2
	SCMS Modification	
17	Local Control Station & Switch	2
18	Power Supply Skid - Packaged Substation	2
19	Solar Power System & Batteries	2
20	Electric Motors (HV and LV)	2
21	Adjustable Speed Drives	2
22	Neutral Earthing Transformer Package	3
23	Low Voltage Bus Duct	2
24	Fault Monitoring System (FMS)	3
25	HV Cables	2
26	HV Cable Termination Kit	2

A1.7 Electrical		
#	Equipment / Item Description	Minimum Criticality Rating
27	LV Power Control and Earthing Cables	3
28	33KV Subsea Composite Cable	2
29	Earthing and Lightning Materials	3
30	Electrical Cable Glands	2
31	Power Receptacles and Switches	3
32	Capacitors (Lights & AC ... etc.)	4
33	Cable Trays and Accessories for E&I	3
34	Electrical Junction Boxes	3
35	Trefoil Cleats, Cable Clamps, Cable Tags, and Route Marker	3
36	Overhead Lines (OHL) 132 kV and 33 KV Lattice Steel Towers OPGW 132 kV and 33 KV Surge Arresters 132 kV and 33 KV Load Break Switches 132 kV and 33 KV XLPE cable	2
37	Fault Limiting Reactor	2
38	Hazardous Bulk Materials	2
39	Non-Hazardous Bulk Materials	3
40	Small Power, Lighting, UPS Distribution Board	3
41	Heat Tracing	3

A1.8. Telecoms

Table A1. 8 Telecom Minimum Criticality Ratings

A1.8 Telecom		
#	Equipment / Item Description	Minimum Criticality Rating
1	Telecoms Systems (SDH, CCTV, PAGA, Radio, Well site)	3
2	Telecom System Package	3
3	Fibre Optic Cables	2
4	Fibre Optic Accessories	3
5	Telecoms Bulk Materials	3

A1.9. Civil / Structural

Table A1. 9 Civil / Structural Minimum Criticality Ratings

A1.9 Structure/Civil		
#	Equipment / Item Description	Minimum Criticality Rating
1	Supply, Fabrication and painting / Galvanizing of Structural Steel Support for Process Items (Beams, ladders, stairs, platforms, handrails, checkered plates, etc)	1
2	Supply, Fabrication and painting / Galvanizing of Structural Steel Support for other structures (Beams, ladders, stairs, platforms, handrails, checkered plates, etc)	2
3	Reinforcement Steel	2
4	Anchor and Structural bolts & nuts	1
5	Hot dip Galvanized Items	3
6	Concrete Aggregates & admixtures	4
7	Cements	4
8	Asphalt based materials	4
9	Cast Iron Covers	4
10	Floor Gratings	4
11	Fencing	4
12	Architectural - Fire Rated Assemblies	1
13	Architectural - Blast Resistant Doors	1
14	Architectural - Water Proofing Materials	3
15	Architectural - Security and Vault Equipment	3
16	Architectural - Cable Support and Fabric Structures	3
17	Architectural – Pre-Engineered Structures/Building/Shelters	3
18	Architectural - HVAC, Plumbing, Electrical Specialities/Systems	3
19	Architectural - Fire Retardant and Intumescence Seals	4
20	Architectural - Solar Energy Systems/Collectors & Solar Control Devices	4
21	Architectural - Floor and Wall Tiles, Natural Stone and Ceramic Toles	4
22	Architectural - Artwork, Signage and Graphics	4
23	Architectural - Pre-Finished Furnitures/Systems and Pre-assembled Systems	4
24	Architectural - Hollow Block Work, Ironmongery, Architectural Metal Work	4
25	Architectural - Window Washing & Building Facade Maintenance Equipment	4
26	Architectural - Aluminium Window Doors	4
27	Architectural - Sloping Glazing Systems, Glazing and Door Assemblies	4
28	Architectural - Sanitary	4

A1.10. Corrosion Protection

Table A1. 10 Corrosion Protection Minimum Criticality Ratings

A1.10 Corrosion Protection		
#	Equipment / Item Description	Minimum Criticality Rating
1	Cathodic Protection	3
2	Pipeline Corrosion Monitoring & Access Fittings	3

A1.11. HSE

Table A1. 11 HSE Equipment Minimum Criticality Ratings

A1.11 HSE		
#	Equipment / Item Description	Minimum Criticality Rating
1	Deluge valves Skid and Spray Nozzles	1
2	Clean Agent system	1
3	Fire Fighting Equipment - Fire Extinguishers, Fire Blankets, Hose Reels, etc.	2
4	Personal Protective Equipment (PPE)	3
5	Safety Signs	4
6	Lifeboats	1



APPENDIX A2. CRITICALITY RATING SHEET TEMPLATE



CRITICALITY RATING SPECIFICATION

AGES-SP-13-001

APPENDIX 2

SAMPLE SPREADSHEET FOR CRITICALITY RATING CALCULATIONS

Contr.

Rev.

Rev Date:

By:

App:

Chkd