INDUSTRIAL TRAINNING REPORT

On

MANUFACTURING OF PNEUMATIC VALVE, PUMP, AND AGITATOR AT IDMC Ltd

Submitted in partial fulfilment towards the degree of

BACHELOR OF TECHNOLOGY

In

MECHANICAL ENGINEERING

Prepared By

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FACULTY OF TECHNOLOGY

DHARMSINH DESAI UNIVERSITY, NADIAD

APRIL 2017

BONAFIDE CERTIFICATE

Certified that the industrial training report titled **"MANUFACTURING OF A PNEUMATIC VALVE, PUMP AND AGITATOR AT IDMC Ltd"** is the bonafide work of **CHUNAWALA HARSHIL V.,TANK KAMAL G.(Roll No. MH-22, MH-129; Bachelor of Technology in Mechanical Engineering, Semester VIII, 2016-17)** who carried out the industrial training under our supervision.

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ABSTRACT

IDMC Limited gives complete dairy solution and produces various types of machines and dairy products while in the case of IDMC unit III, manufactures many products as part of daily production. As a part of industrial training, we focus on analyzing of pneumatic valve, pump, and agitator manufacturing processes and pick up as a study project as well as a training report (B-Tech). Present work during 3 months of training, we try to evaluate shop floor layout, operation process chart, flow diagrams of main components, scheduling and production of a pneumatic valve with at most accuracy, in accordance with short description of hydraulic pump and agitator. Last at a project report we applied and follow steps of a method study and try to critically evaluate parts material movement a pneumatic valve.

ACKNOWLEDGEMENT

It is indeed a great pleasure to express our thanks and gratitude to all those who helped us during this training. This training would have been materialized without the help from many who asked us good questions and rescued from various red tape crisis.

Theoretical knowledge is of no importance if one doesn't know the way of its implementation. We are thankful to our university that provided us an opportunity to apply our theoretical knowledge through the industrial training. We feel obliged in submitting this project as part of our curriculum.

We would like to take the opportunity to express our humble gratitude to our guide Mr. J.M. RAVALJI, Faculty of MH Department, D.D.U under whom we undertook our industrial training. His constant guidance and willingness to share his vast knowledge made enhance my knowledge and helped us to complete the assigned tasks to perfection. Without his effort and full support, this project may not have succeeded.

We would also like to take the opportunity to express our humble gratitude to our guide Mr. Pritsh Modi, Plant Head of M/s. IDMC Unit-III, under whom we undertook our industrial training. His constant guidance and willingness to share his vast knowledge made us enhance our knowledge and helped us to complete the assigned tasks to perfection. Without his effort and full support, this training may not have succeeded.

At last, we would like to thanks Mr Sanjay Patel, Mr Dinesh Tadha, Mr Ajay Shankhla, Mr Ravindra Patel, Mr Jayesh Thakar, whose effort towards to improve our small mistakes as well as guidance to sharpen our knowledge in the mechanical industries.

Although, there may be still many who are unacknowledged in this humble vote of thanks, there are none who remain unappreciated.

With Sincere Regards,
Chunawala Harshil V.
Tank Kamal G.

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1 COMPANY PROFILE

IDMC Limited was setup in 1978 to manufacture dairy component and equipment and sell it to their moderate prices. IDMC was incorporated as a wholly owned subsidiary company of National Dairy Development Board (NDDB) in 1992 and became a deemed public company on 1st of July, 1995.IDMC was incorporated as a private limited company on September 14, The company can be defined as a medium scale unit.

IDMC has a big machine shop is equipped with several CNC machining centres and pump manufacturing centre. A complete range of sanitary fittings, unions, tri-clover clamps, band, tees, butterfly valve, plug valve, safety valve, non return valve, check valve, pneumatic valve etc supply to IDMC's unit as well as to other industries, dairy, pharmaceuticals, beverages sectors. Pump shop manufactures turbo blenders, pumps, agitators while machine building development another section manufactures dairy processing machines like ice cream freezers, fruit feeder, continuous butter making machine, homogenizers and cup filling machine. This unit have adequate quality control laboratory within house infrastructure and train personnel to test analyze raw materials, intermediate products and finish goods with speed and accuracy.

FIG-1 PRUDUCTS OF IDMC UNIT-III

IDMC IS DIN EN ISO 9001:2015 CERTIFIED COMPANY

TÜV NORD

CERTIFICATE

Management system as per
ISO 9001 : 2015

In accordance with TÜV NORD CERT procedures, it is hereby certified that

IDMC LIMITED-UNIT III
Works:- Plot No. 606-608, G.I.D.C Estate, Vithal Udyognagar, Anand - 388 121, Gujarat, India

IDMC LIMITED

applies a management system in line with the above standard for the following scope

Design, Development, Manufacture, Supply & Service of Pumps, Valves, Fittings and Agitator

Certificate Registration No. **44 100 074054**
Audit Report No. **2.5- 3567/2007**

Valid until **06.03.2019**
Valid from **07.03.2016**
Initial certification **07.03.2007**

Certification Body
at TÜV NORD CERT GmbH

Issue **22.02.2016**
Place : **Mumbai**

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

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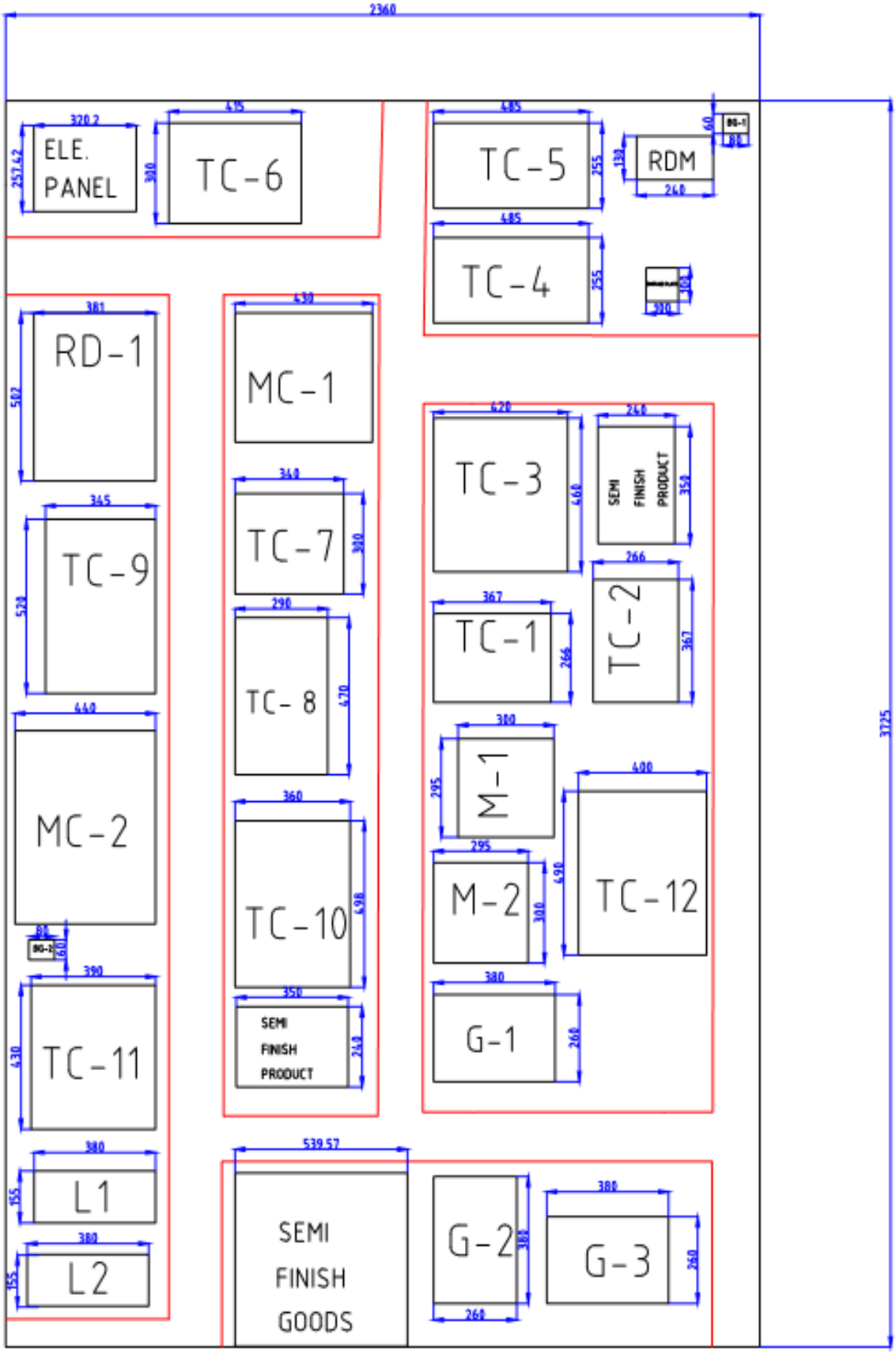
DAkkS Deutsche Akkreditierungsstelle D-ZM-12007-01-01

1.1 MACHINE SHOP LAYOUT



1.2 LIST OF MACHINES

SR. NO.	DESCRIPTION
1	HORIZONTAL TURNING CENTRE-1
2	HORIZONTAL TURNING CENTRE-2
3	HORIZONTAL TURNING CENTRE-3
4	HORIZONTAL TURNING CENTRE-4
5	HORIZONTAL TURNING CENTRE-5
6	HORIZONTAL TURNING CENTRE-6
7	HORIZONTAL TURNING CENTRE-7
8	HORIZONTAL TURNING CENTRE-8
9	HORIZONTAL TURNING CENTRE-9
10	HORIZONTAL TURNING CENTRE-10
11	HORIZONTAL TURNING CENTRE-11
12	VERTICLE TURNING CENTRE-12
13	HORIZONTAL TURNING CENTRE-1
14	VERTICLE MILLING CENTRE-1
15	VERTICLE MILLING CENTRE-2
16	CYLINDRICAL GRINDING MACHINE-1
17	CYLINDRICAL GRINDING MACHINE-2
18	CYLINDRICAL GRINDING MACHINE-3
19	RADIAL DRILLING MACHINE
20	MANUAL LATHE MACHINE-1
21	MANUAL LATHE MACHINE-2
22	MANUAL MILLIMG MACHINE-1
23	MANUAL MILLIMG MACHINE-2
24	VIBRATING MACHINE-1
25	BATCH GRINDER-1

2 PNEUMATIC VALVE

2.1 INTRODUCTION

Pneumatic valve control the process parameter like flow, pressure, process fluid in the balance tanks by changing valve opening area. The process parameters are monitored by instruments like flow meter, pressure transmitter, temperature transmitter etc. The signals from the instrument are transmitted by PID system that sends control signal i/p converter to control pneumatic pressure in the actuator.

The valve is provided with pneumatic actuator having a rolling diaphragm. Valve opening is controlled by applying counter pneumatic pressure in the diaphragm against fluid pressure in the valve. The valve needs minimum 0.5 bar to operate it.

The valve disc may be single or double seated and have any of a variety of shapes. The various shapes and types are chosen according to the type of control required and the relationship between valve lift and liquid flow.

2.2 TECHNICAL SPECIFICATION

The valve is suitable for operating pressure	: 4 bar
Maximum pressure to be take	: 8bar
Testing pressure	: 6bar
Maximum working temperature	: 135°c
Seals	: EPDM/ NITRILE/ VITON/ TEFLON
Size available	: 25.4, 38.1, 50.8, 63.5, 76.1, 101.2 mm
Type	: ‘L’, ‘LL’, ‘TL’, ‘LT’, ‘TT’ & ‘T’

(*As per user manual for pneumatic valve of idmc ltd.)

2.3 SILENT FEATURES OF PNEUMATIC VALVE:

- Modular design.
- Spherical shape of body with smooth passage resulting into minimum pressure drop.
- Fully drainable and no hold of liquid pool.
- Machined from 316L stainless steel round bar.
  Spherical profile gasket housed in the body groove in line with recommendation of din 118864-2 for better hygienic design.

2.4 PARTS OF PNUEMATIC VALVE

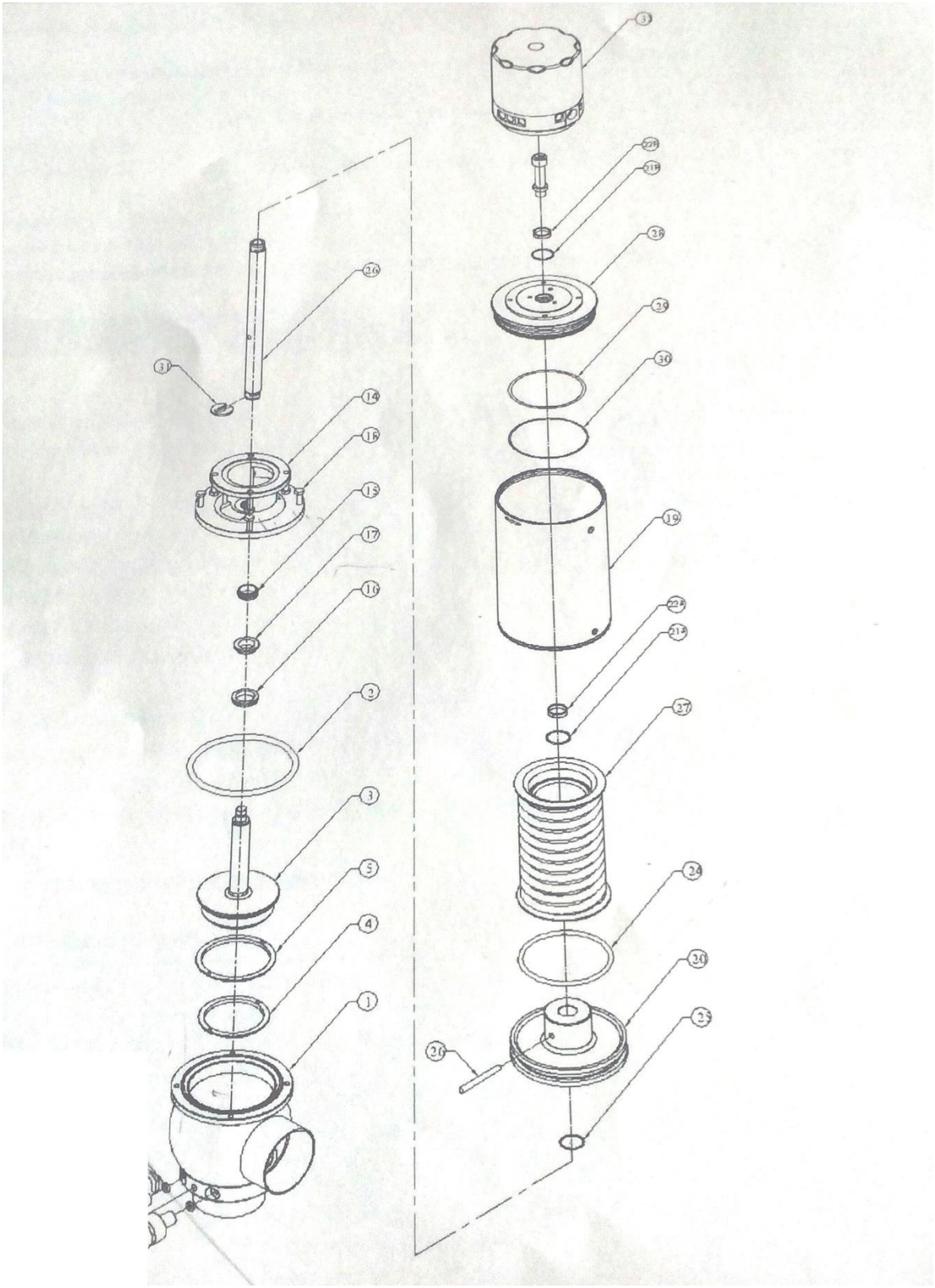


FIG.-2 PARTS OF PNEUMATIC VALVES

(*As per user manual for pneumatic valve of idmc ltd.)

MASTER LIST OF PARTS (BILL OF MATERIAL)

SR.NO.	PART DESCRIPTION	QTY
1	VALVE BODY	2
2	BODY ‘O’ RING	2
3	VALVE DISC	1
4	SQUARE RING FOR LOWER SEAT	1
5	SQUARE RING FOR UPPER SEAT	1
6	LANTERN	1
7	SPLIT PIN	1
8	TEFLON BUSH	1
9	RUBBER BUSH	1
10	HEX. SOCKET HEAD SCREW	12
11	CYLINDER PIPE	1
12	CYLINDER BOTTOM FLANGE	1
13	BOTTOM FLANGE U SEAL	1
14	TOP COVER U SEAL	1
15	BOTTOM FLANGE SLIDE BAND	1
16	TOP COVER SLIDE BAND	1
17	PISTON	1
18	PISTON ROD	1
19	PISTON OUTER O RING	1
20	PISTON INNER O RING	1
21	CIRCLIP	1
22	PIN	1
23	SPRING ASSEMBLY	1
24	TOP COVER	1
25	BOTTOM COVER	1
26	CONNECTING FLANGE	1
27	LOCKING WASHER	1
28	CONTROL CAP	1

(*As per user manual for pneumatic valve of idmc ltd.)

2.1 PART DESCRIPTION

1) UPPER ELEMENT:

Description:

Upper element is assembles with the lower body as well as lantern. This type of configuration may allow the liquid to flow through the outlet pipe. Upper element allows the smooth flow of air/ liquids due to its smooth inner curvature of element. It has a seat to rest the valve disc. It has a groove which contain ‘o’-ring and allows the valve to reduce leakage.

OPERATION SEQUENCE:

MATERIAL : SS316L, SMS50.8, L@WLD

QTY : X

OPERATION SEQUENCE	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	TURNING
4	MILLING
5	DRILLING
6	DRIILING AND TAPPING
7	DEBURRING
8	CLEANNING & WASHING
9	WELDING

2) LOWER ELEMENT:

Description: Lower element is lower most part of the pneumatic valve which is sometimes neglected if the configuration is only ‘L’ or ‘T’ type. This type of configuration may allow the liquid to flow through the inlet as well as outlet which is weld at lower body. Above an all it welds with the pipe at the site with define position (vertical or horizontal). Many times lower body takes stress of back pressure and shape of element allows the smooth flow of air or liquids. It allows the valve disc to seat on grooves of lower element. It has a groove which contain ‘o’-ring and allows the valve to reduce leakage.

OPERATION SEQEUNCE:

MATERIAL : SF, SS316L, SMS50.8, L@WLD

QTY : X

OPERATION NUMBER	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	TURNING
4	MILLING
5	DRILLING
6	DRIILING AND TAPPING
7	DEBURRING
8	CLEANNING & WASHING
9	WELDING

3) CYLINDER:

DESCRIPTION: It is a main part of pneumatic valve which holds piston, damper spring, piston rod. This assembly is called as a liner actuator. It provides the space for piston to move up and down in the valve. It also has two holes for inlet and outlet supply air for actuate piston to move. It is assemble between control head and lantern.

OPERATON SEQUANCE:

MATERIAL : 304, PNU, LINEAR, ACTR,
QTY : X

OPERATON SEQUANCE	OPERATION DESCRIPTION
1	WELDING
2	OD TURNING
3	ID GRROVING AND FACING
4	ID TURNING
5	DRILLING PCD
6	SLOTING

7	CLEANNING AND WASHING
8	DEBURRING
9	BLASTNG
10	CLEANNING WITH OIL

3) LANTERN COVER:

DESCRIPTION: Lantern is located in middle between cylinder and upper body. It allows more space to move piston and piston rod. It gives support to actuator assembly and other pneumatic valve components. Lantern provides constrain motion (single degree of freedom) to the piston rod and via valve disc. Lantern contains the assembly of rubber seal and gasket to the groove of it and this allows a valve, reduce wear and tear of piston rod and valve rod.

OPERATION SEQEUNCE:

MATERIAL : LTCOVER, 316, PNV SMS50.8
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	PROOF MACHINNING
2	TURNING
3	TURNING
4	DRIILING
5	DRILLING
6	WASHING AND CLEANNING
7	CAST SKIN REMOVING
8	DEBURRING AND DRILLING FOR NAME PLATE
9	BLASTING
10	CLEANNING WITH OIL

4) VALVE DISC:

DESRIPTION: The valve disc is seat on bottom seat of lower body and top seat of lower body. A main function of valve disc is to control flow of liquid in pipes and fittings according to i/p signal via actuator. Valve disc assembles to piston rod by internal tapping of piston rod. Valve disc actually take up the input pressure of liquid which is enter to the inlet pipe.

OPERATION SEQEUNCE:

MATERIAL : 316L PNV,LLT,
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	FACING AND OD TURNING
2	PRE MACHINNING
3	TURNING
4	TURNING
5	MILLING
6	DEBURRING
7	WASHING AND CLEANNING

5) TOP COVER:

DESRIPTION: Top cover is located on top of cylinder as a transition fit by means of circlip. It has a hole on top of it which allows to movements of piston and piston rod.

OPERATION SEQEUNCE:

MATERIAL : 304, PNV, LINER ACTR, ID 96
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	DRIILING PCD
4	DRILLING VERTICAL
5	WASHING AND CLEANING
6	BLASTNG
7	CLEANNING WITH OIL

6) PISTON ROD:

DESRIPTION: Piston rod assembles to the piston by means of split pin and connected to a valve disc at bottom by means of outer tapping on valve disc. It is move with the piston by action of actuator.

OPERATION SEQEUNCE:

MATERIAL : 304,PN
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	DRIILING & MILLING
4	DRILL BOTH ENDS
5	THREADS BOTH ENDS
6	DEBURRING
7	CLEANNING & WASHING

7) PISTON:

DESRIPTION: Piston is located inside in cylinder and connected to piston rod by split pin. Piston is one of the main part of actuator assembly. Piston is reciprocated in cylinder by the supply of pressurised air at inlet and outlet port. Piston has rubber seal on its grooves which provides air-tight function for actuator assembly.

OPERATION SEQEUNCE:

PLANT : GJMD
MATERIAL : 304,PN
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	PRE-MACHINING
2	TURNING
3	TURNING
4	DRILLING
5	DEBURRING
6	CLEANNING & WASHING

8) CONTROL HEAD:

DESRIPTION: Control head gets the electric signals, process it and according to i/p current it actuate control cam and allows a piston to flow in the actuator . Control head contains assemblies of various solenoid valves, supply pressure port and locking groove for connecting actuator assembly to the bottom of the control head.. It is directly purchase from Burkert fluid control System Company.

OPERATING CONDITION:

Ambient temperature	-10°c to 55°c (normal pressure condition)
(Working temperature)	5°c to 55°c (explosive atmosphere)
Temperature range of compressed air	-10°c to 50°c
Pressure range	2.5 bar to 8 bar
Stroke range	0 to 80 mm
Control medium	Air, neutral gases (accordance iso 8573-1)
Power supply	110/130 ac, 50/60 Hz
Power consumption	110ma at 120 v ac
Type	8681

(*As per user manual for pneumatic valve of idmc ltd.)

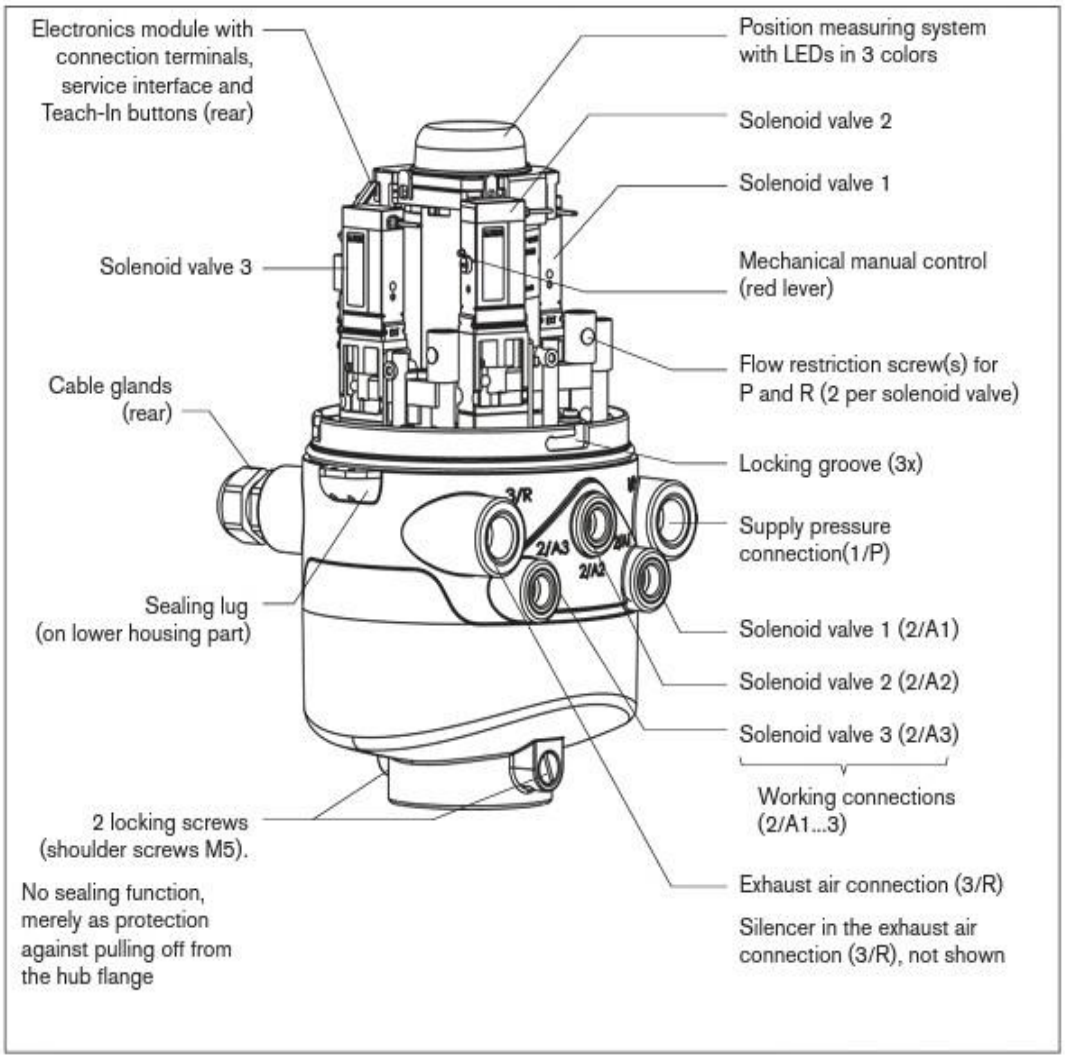


FIG-3 CONTROL HEAD

9) CONNECTING FLANGE:

DESRIPTION: It is mounted on a top cover and bottom of the control head. It separates control head to the actuator. Connecting flange has a grooves to which rubber "O" rings is provided and on it control head resting by means of screw.

OPERATION SEQEUNCE:

PLANT : GJMD
MATERIAL : 304, PNV, BRKT, 8681, ID96
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	TURNING
4	DRILLING
5	CLEANNING & WASHING
6	DEBURRING

10) CONTROL CAM:

DESRIPTION: It is mounted on a top cover and bottom of the control head. It separates control head to the actuator. Connecting flange has a grooves to which rubber "O" rings is provided and on it control head resting by means of screw.

OPERATION SEQEUNCE:

PLANT : GJMD
MATERIAL : 304, PNV, BRCKT THRD
QTY : X

OPERATION SEQEUNCE	OPERATION DESCRIPTION
1	TURNING
2	TURNING
3	TURNING
4	MILLING
5	DEBURRING AND ABRASSIVE WHEEL
6	CLEANNING & WASHING

2.5 TESTING OF PNEUMATIC VALVE

Testing of pneumatic valve is done in following sequence (IN HOUSE)

1. Stroke testing:

   After assembly of pneumatic valve at a time six valve is putted on the testing on stroke measuring machine, on which stoke occurs at the interval of 7 to 8 second up to 250 strokes in order to check any type of damages occur in gasket during stroke operation in the valve.

2. Visual checking:

   Quality checking by QC inspector to see whether there is any fault in the gasket or valve disc.

3. Hydraulic testing:

   In the hydraulic testing, valve is put between the fixture (to close the end of valve) then pressurised the valve up to 6 bar for to 15 to 20 minute and watch whether any Leakages are there from valve disc.

Testing of pneumatic valve is done in following sequence:

(AT SITE RECOMMENDATION)

- Actuator connection for leakage
- Valve body ‘o’ ring and valve disc gasket
- Clean air filter at regular interval
- Whether control unit cap is completely tighten**.**

NOTE: In order to check pneumatic valve, QC department check 100% inspection just in order to verify whether there is wearing of valve seat gasket occurs or not. Due to this practise it is wastage of time and energy of QC department so our suggestion to company is test should occur in following manner:

1) Hydraulic testing

2) Visual checking

There is no 100% requirement of stroke testing instead of we can do R&D of Some of the samples (sampling procedure testing) and if there is no complain from customers over a long time then we should follow our old regular testing methods.

3 CENTRIFUGAL PUMPS

3.1. INTRODUCTION

The centrifugal pump of CL/CLC is a range of mono block type centrifugal pump with a hygienic design suitable for use in dairy, beverages, and food industries in general. This single stage horizontal pump has a casing with axial suction and tangentially discharge. The main pump component are shaft, which is inbuilt with a motor, mechanical seals, casing, cover, clamp, impeller, motor, shroud, level adjuster, rear foot and front foot.

As a general rule CL/CLC pumps in their standard version are used in food industries mainly to transfer liquid. For each type of pump hydraulic performance is given by the choice of impeller with different types, diameter and a speed. The characteristic curves also indicate power and efficiency requirement as per pump test report.

The centrifugal pump is the most used pump type in the world. The principle is simple, well-described and thoroughly tested, and the pump is robust, effective and relatively inexpensive to produce. There is a wide range of variations based on the principle of the centrifugal pump and consisting of the same basic hydraulic parts.

3.2 PRINCIPLE OF THE CENTRIFUGAL PUMP

An increase in the fluid pressure from the pump inlet to its outlet is created when the pump is in operation. This pressure difference drives the fluid through the system or plant. The centrifugal pump creates an increase in pressure by transferring mechanical energy from the motor to the fluid through the rotating impeller. The fluid flows from the inlet to the impeller centre and out along its blades. The centrifugal force hereby increases the fluid velocity and consequently also the kinetic energy is transformed to pressure. Figure shows an ex- ample of the fluid path through the centrifugal pump.

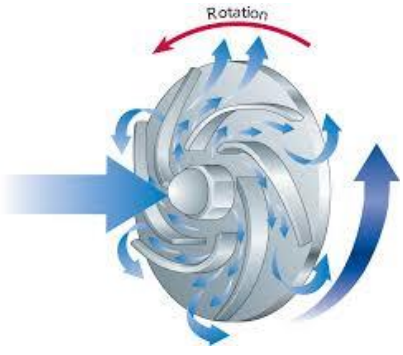


FIG- 4 PRICIPLE OF CENTRIFUGAL PUMP

3.3 TECHNICAL SPECIFICATION:

Capacity	: KLPH
Maximum operating pressure	: 7 BAR
Mechanical seal Type	: SIC/ C
Rubber and Gasket	: EPDM
Motor	: 3 phase, 50 Hz,
Mode of operation	: VFD / without VFD
Power	: 0.75 to 15 Kw
Operating Temperature rang	: 10 to 120 ℃
CIP/ SIP Temperature rang	: 90 to 150 ℃
Maximum speed	: 2900 RPM

FIG-5 CENTRIFUGAL PUMP

(*As per user manual for pneumatic valve of idmc ltd.)

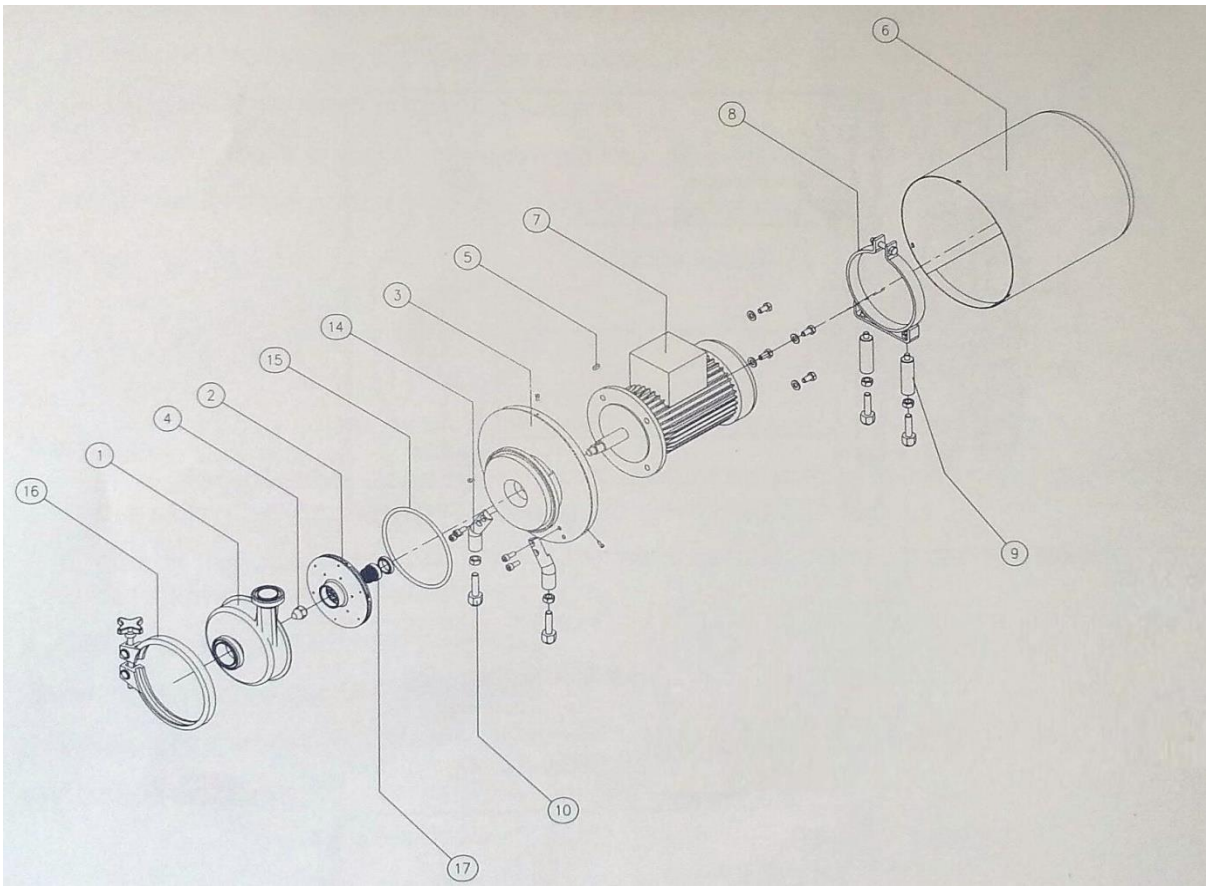


FIG-6 EXPLODED VIEW OF PUMP

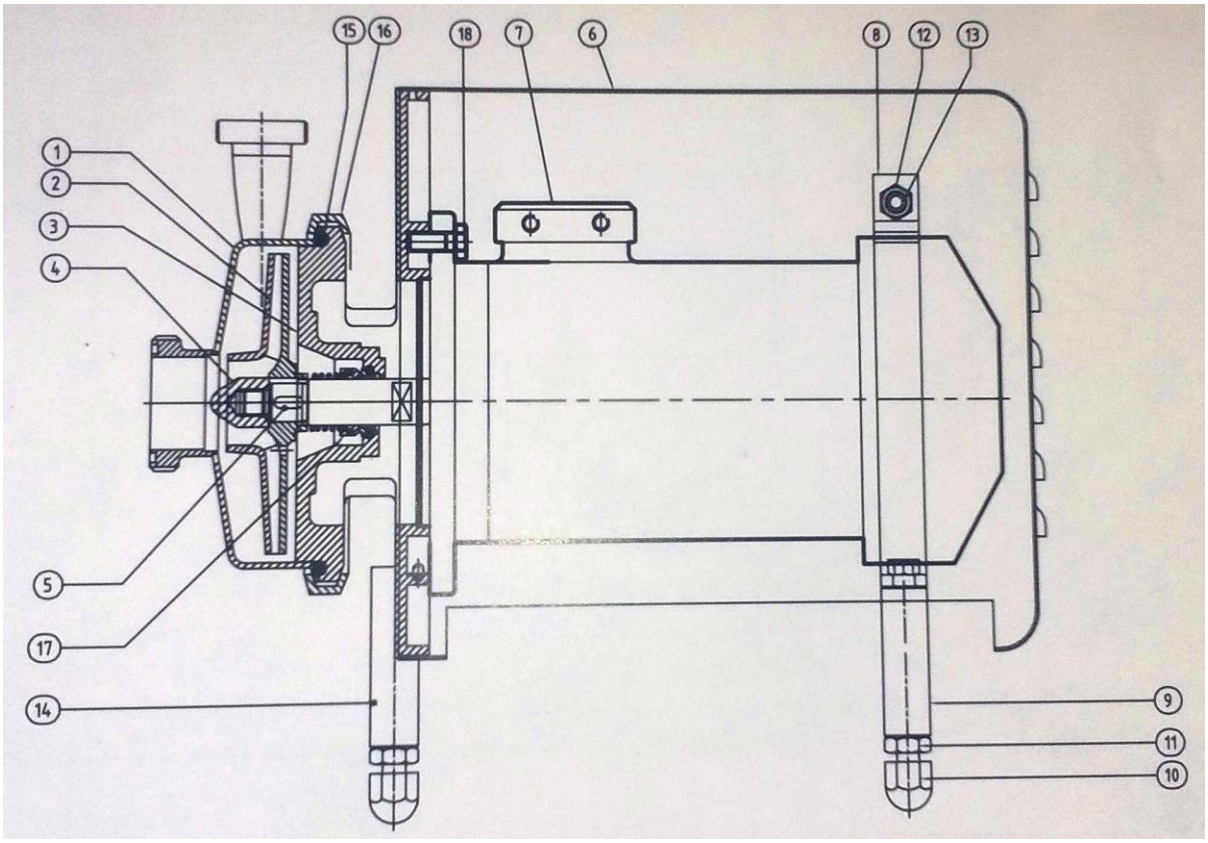


FIG-7 FRONT VIEW OF PUMP

(*As per user manual for pneumatic valve of idmc ltd.)

3.4 LIST OF PARTS (BILL OF MATERIAL)

SR.NO.	DESCRIPTION	QTY.	MATERIAL
1	Casing	1	AISI 316L
2	Impeller	1	AISI 316L
3	Cover (T Execution)	1	AISI 316L
3.0	Cover (U Execution)	1	AISI 316L
3.1	Mechanical Seal Box	1	AISI 316L
3.2	Hex. headed Cap screw		AISI 304
3.3	O Ring	1	EPDM
3.4	O Ring	1	EPDM
3.5	Ceramic hardening bush	1	CERAMIC
3.6	Rotary shaft seal	1	EPDM
3.7	Circlips	1	Carbon steel
3.8	Pipe for water flushing In	1	AISI 304
3.9	Pipe for water flushing Out	1	AISI 304
4	Impeller nut	1	AISI 316L
5	Key	1	AISI 316L
6	Shroud	1	AISI 304
7	Motor	1	STD
8	Rear foot clamp	1	AISI 304
9	Rear foot	2	AISI 304
10	Lever adjuster	4	AISI 304
11	Hex headed nut	4	AISI 304
12	Hex headed bolt	1	AISI 304
13	Hex headed nut	1	AISI 304
14	Front foot	2	AISI 304
15	O ring	1	EPDM
16	Clamp	1	AISI 304
17	Internal mechanical seal	1	-
17.1	External mechanical seal	1	-
18	Hex headed bolt	4	AISI 304

(*As per user manual for pneumatic valve of idmc ltd.)

3.5 PART DESCRIPTION

CASING:

The main function of casing is to convert desire kinetic energy of the liquid discharge at the outlet of impeller into the pressure energy before the liquid leaves the casing and enter the delivery pipe as well as the guide liquid to and from the impeller.

Casings is a curved funnel increasing in area to the discharge port As the area of the cross-section increases, the volute reduces the speed of the liquid and increases the pressure of the liquid. The impellers are fitted inside the casings. One of the main purposes of a casing is to help balance the hydraulic pressure on the shaft of the pump. However, this occurs best at the manufacturer's recommended capacity.

FIG-8 CASING

IMPELLER:

It is a wheel on which vanes r blades are fixed or inbuilt. Impeller is mounted on the motor shaft usually no of blades are vary from 6 to 12. The main function f impeller is to impart centrifugal forces to liquid and increase the pressure and kinetic energy of a liquid, which is transfer from suction side to delivery side.

Closed impellers are the most commonly used impellers in the industry since they can deal with volatile and explosive fluids. An open impeller is less likely to get clogged and even if it does, it is easier to clean whereas in a closed impeller, if stringy material or solids are pumped, the impeller can clog and it becomes really difficult to clean them.

The open impeller vanes are open on both the sides, no side plates are provided as shown in figures. Such pumps are used to handle liquid like abrasive liquid mixture of water and sand particle such as chocolates, sugar syrup etc. The pump with open impeller is used for rough duty.

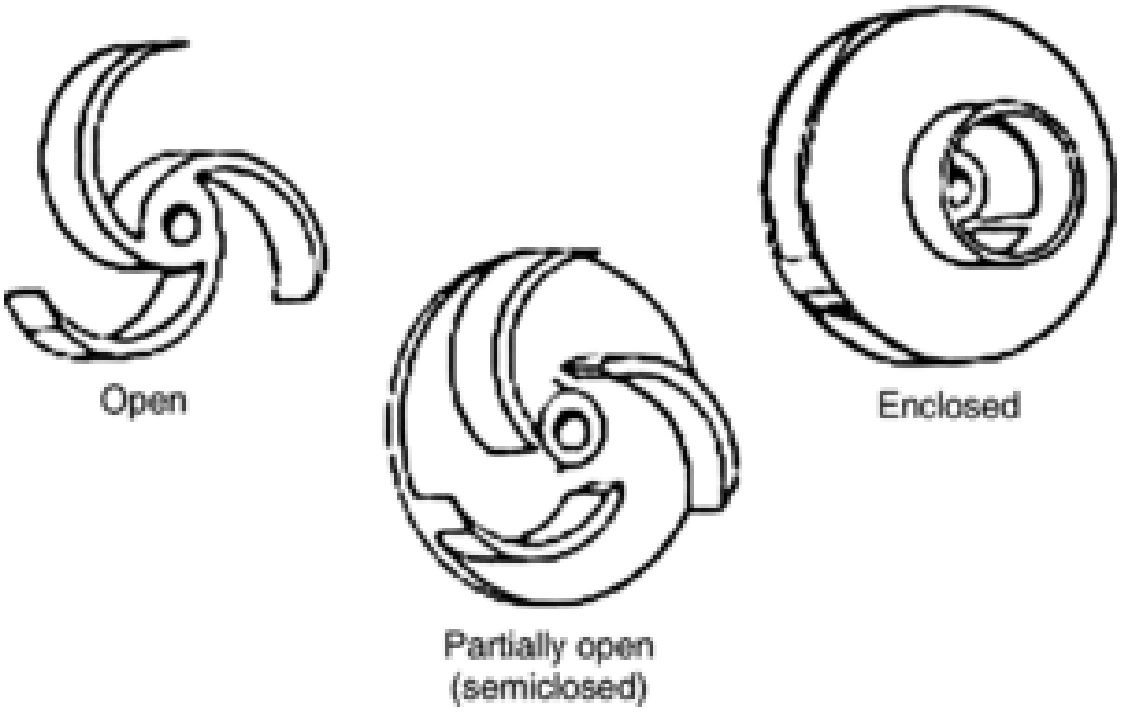


FIG:9 TYPES OF IMPELLER

ELECTRICAL MOTOR :

Electrical motor is major part in centrifugal pump which use to drive impeller inside a casing.There are depending upon capacity of centrifugal pumps various range of motor are available in market. Generally electrical motors in range of 1 hp to 7.5 hp are used in centrifugal pump.impeller is mounted on motor shaft by means of key and rotate with moror speed.

Fig.-10 ELECTRICAL MOTOR

3.6 Performance of centrifugal pump

The pump performance is normally described by a set of curves. This chapter explains how these curves are interpretive and the basis for the curves. Standard curves Performance curves are used by the customer to select pump matching his requirements for a given application. Following are the important characteristics for a centrifugal pump:

1. Main characteristics curve
2. Operating characteristics curve
3. Constant efficiency/ Muschel characteristics curve

The data sheet contains information about the head (H) at different flows (Q), see figure The requirements for head and flow determine the overall dimensions of the pump.

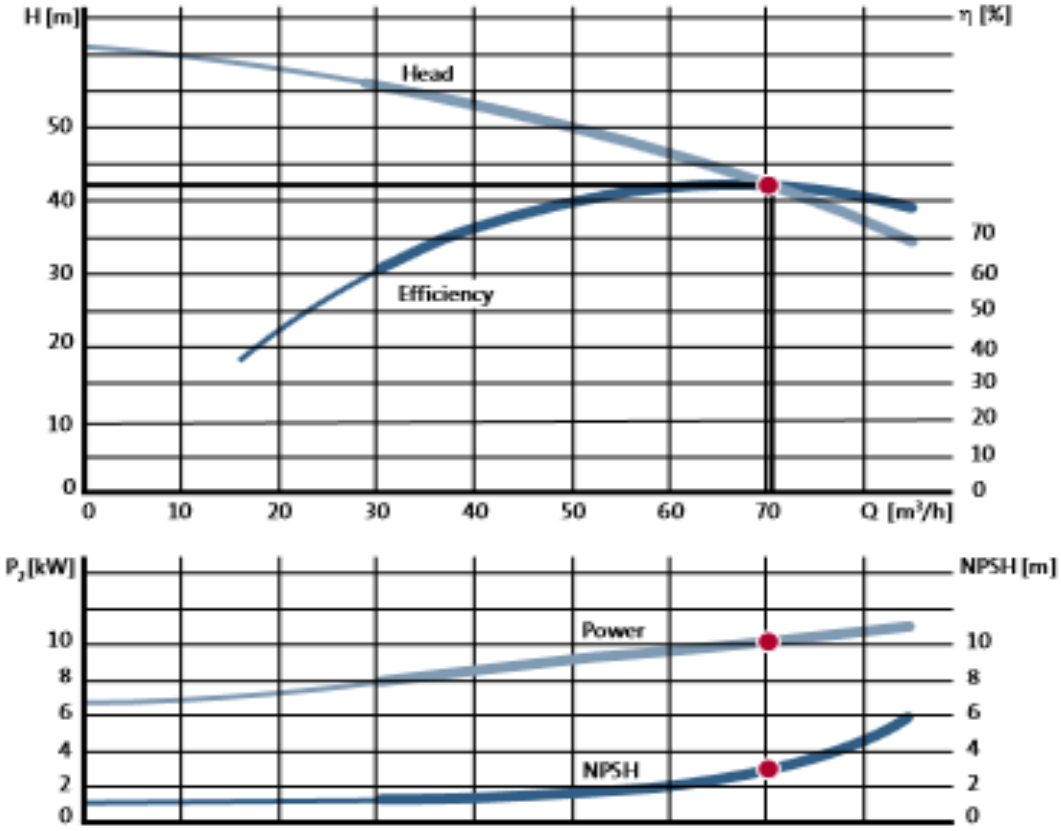


FIG-11 STANDARD PERFORMANCE CURVES

In addition to head, the power consumption (P) is also to be found in the data sheet. The power consumption is used for dimensioning of the installations which must supply the pump with energy. The power consumption is like the head shown as a function of the flow.

Information about the pump efficiency (η) and NPSH can also be found in the data sheet. NPSH is an abbreviation for 'Net Positive Suction Head'. The NPSH curve shows the need for inlet head, and which requirements the specific systems have to fulfil to avoid cavitations. The efficiency curve is used for choosing the most efficient pump in the specified operating range. Figure shows an example of performance curves in a data sheet.

NPSH:

The term NPSH (The net positive suction head) is very commonly used in pump industries. Actually minimum suction conditions are more frequently specified in terms of NPSH. NPSH is defining as the deference between absolute pressure head at the inlet to the pump to the vapour pressure head and addition to velocity head.

For any pump installation, a distinction is made between the required NPSH and available NPSH. The value of required NPSH is given by pump manufacture and this value can also be determined by experimentally. When the pump is installing in order to have cavitations free operation of pump, the available NPSH is greater than the required NPSH.

HEAD:

The concept of head is used for Newtonian fluids or true fluids such as water and petrol like non-viscous liquids. Hence, the term head is basically the measurement of kinetic energy created by the pump. It measures the height of a liquid column which the pump creates. Head measures energy of the centrifugal pump. The end users can describe the performance of a pump on any Newtonian fluid, be it as heavy as sulphuric acid or as light as gasoline, by using head. Here, head relates to the velocity gained by the liquid while moving through the pump.

POWER CONSUMPTION (SHAFT POWER):

Power consumed by pump during operation. Power consumption differs from pump useful capacity consumed directly for imparting of energy to the pumped medium. Part of consumed power can be lost due to leakages, bearings friction, etc. Performance factor determines ratio between these quantities. Calculation of these characteristic may vary for different types of pumps, which is associated with differences in their design and operating principles.

$$N_{П} = \rho \cdot g \cdot Q \cdot H$$

$N_{П}$ – useful power, W ρ – density of the pumped medium, kg/m^3

g – gravity acceleration, m/s^2 Q – flow rate, m^3/s

H – total head, m

DISCHARGE:

Discharge can be measure by flow meter in m^3/Hr and in the case of pump, it is directly associated with the velocity and pump outlet diameter. In the test section discharge is one of the parameter to test performance of a pump.

$$Q=A*V$$

where,

Q= Flow in a pipe in m^3/Hr

A=Area of pump in m^2

V= velocity of pump in m/sec.

4 AGITATORS

4.1 INTRODUCTION

Agitator is a device used to mix the fluid in the vessels as well as on the truck containing the fluid/semi liquid. There are many types of agitators available depending upon the products ranging from chemicals, food, pharmaceuticals, organics, petro-chemicals, cosmetics etc. The type of operation and equipment used during mixing depends on the state of materials being mixed (liquid, semi-liquid, or solid). Idmc Limited produces liquid and semi-solid mixing agitators.

4.2 PRINCIPLE:

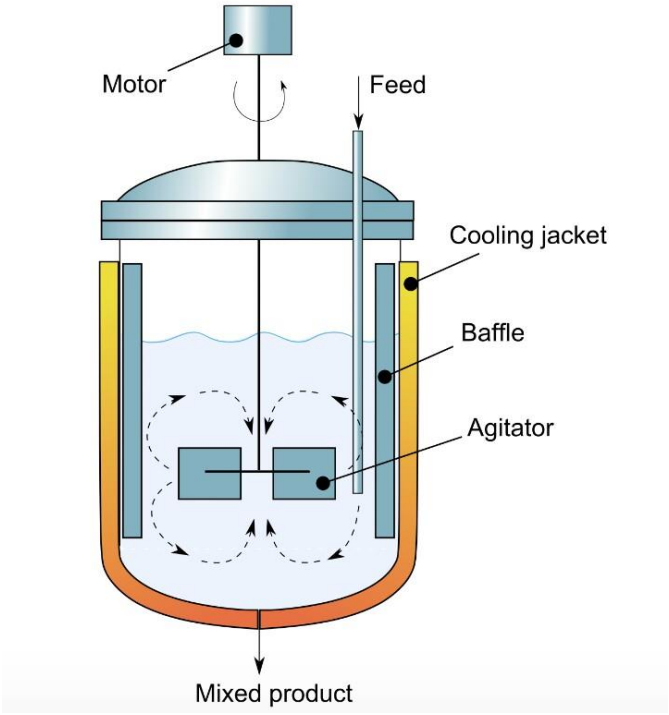


FIG. 12 PRINCIPLE OF AGITATOR

An agitator is a device or mechanism to put something into motion by shaking or stirring. In general, agitators usually consist of an impeller and a shaft. An impeller is a rotor located within a tube or conduit attached to the shaft. It helps enhance the pressure in order for the flow of a fluid be done. Modern industrial agitators incorporate process control to maintain better control over the mixing process. The design and the operation of the agitator are crucial for efficient operation. However, there is no strict science that governs the best design. Rather, the designing of good process agitators is more a matter of experience. Core knowledge of fluid dynamics is must for good agitator design.

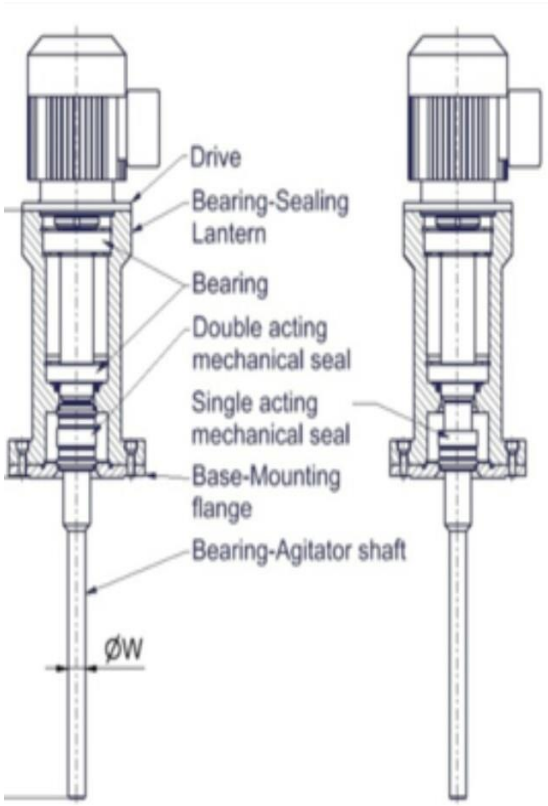


FIG. 13 SCHEMATIC DIAGRAM OF AGITATORS

FIG. 14 ACTUAL DIAGRAM OF TANK AND VESSALS

4.3 LIST OF PARTS (BILL OF MATERIAL)

Sr No	ITEM DESCRIPTION	Qty
1	Motor	1
2	Drive shaft	1
3	Mounting flange	1
4	Steady support	1
5	Canopy	1
6	Lock washer	1
7	Lock nut	1
8	Hex. Headed nut	12
9	Hex. Headed bolt	12
10	Allen screw	6
11	Key	1
12	Leap seal/ Mechanical seal	1
13	Steady support bush	1
14	Spring washer	1

4.4 COMPONENTS OF AGITATOR

1. MOTOR:

There are different types of motor available depending upon application of agitator. Motors are generally equipped with gear box assembly with star/delta connections as per electric configuration.. It is the main part of assembly because whole power is gain from this unit.

FIG-15 MOTOR WITH GEAR BOX

TECHNICAL SPECIFICATION:

POWER	: 0.75KW
POWER FACTOR	: 0.74
VOLTAGE	: 415V
FREQUENCY	: 50 +/- 5%
TYPE	: KAF57 DIBE80M4
RPM	: 1430
MAKE	: SKF EURODRIVE

2. GEAR BOX:

Function of gear box is to increase the torque and decrease the torque according to requirement of agitator. Generally gear box are reduced RPM type and make the rpm up to 25 to 30 and assembles with motor. In the case of IDMC's agitators removing of circlip is necessary for installation of drive shaft.

3. DRIVE SHAFT:

Drive shaft is connected to motor and serves as connections to agitator. It generally have step shaft and connected to gear motor by lock nut and lock washer. Many agitators are equipped with bearing assembly in which self aligning roller bearing etc types is there.

4. AGITATOR SHAFT:

Agitator shaft is connected to drive shaft with hexagonal bolts. It is support by steady support at the end of shaft. It is the main unit of silos and actual mixing of liquid or semisolid is done by agitator shaft. Agitator shaft provides whirling of liquid in the tank in the direction of a tank/vessels. In order to mix the liquid centrifugal force is used by the agitator shaft.

FIG-16 AGITATOR

5. CANOPY:

Canopy is locates on a motor on the top of it. It serves the function of a protecting the motor from various environmental effect like dust particle, water and rusting effect of motor. It is located on the top of the silos and design of canopy is such that it provides ventilations to the motor. It is made of tin or aluminium material by press or development. Shape of canopy depends upon motor configuration.

FIG-17 CANOPY

6. STEADY SUPPORT:

Steady support is located on the bottom of the tank either assembles to it or welded to it. It provides supports to the agitator shaft so that at higher loads agitator does not twisted nor whirls. Steady support provides with rubber bush and acts as a frictionless material to the shaft.

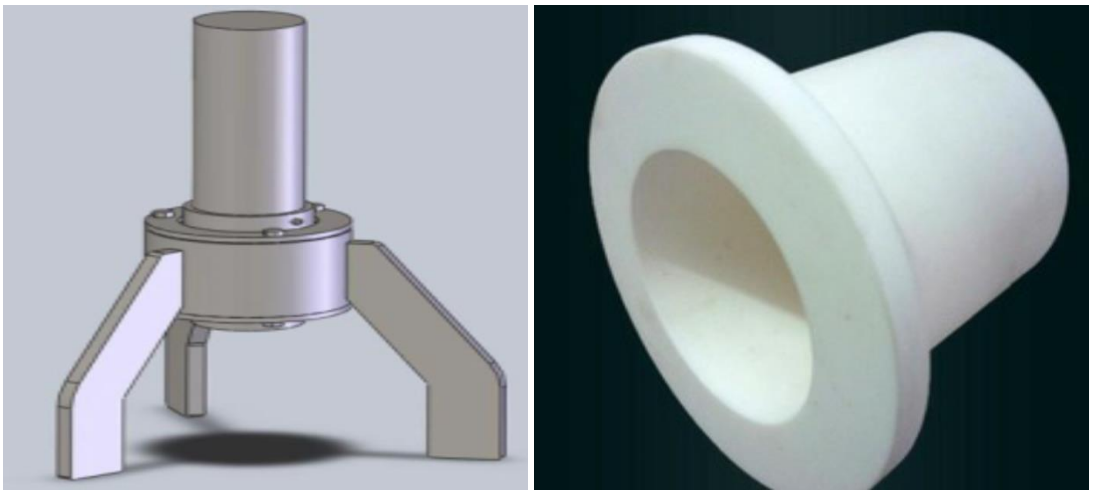


FIG-18 STEADY SUPPORT AND BUSH

LOCK NUT/WASHER:

Function of lock nut and lock washer is to fix drive shaft in the motor and adjust the height of agitator above and all it can be use to adjust run out of the shaft. Lock nut used in the IDMC is union nut of SS304. It is the only part which made in the unit-III while all other parts are directly purchased from outsides.

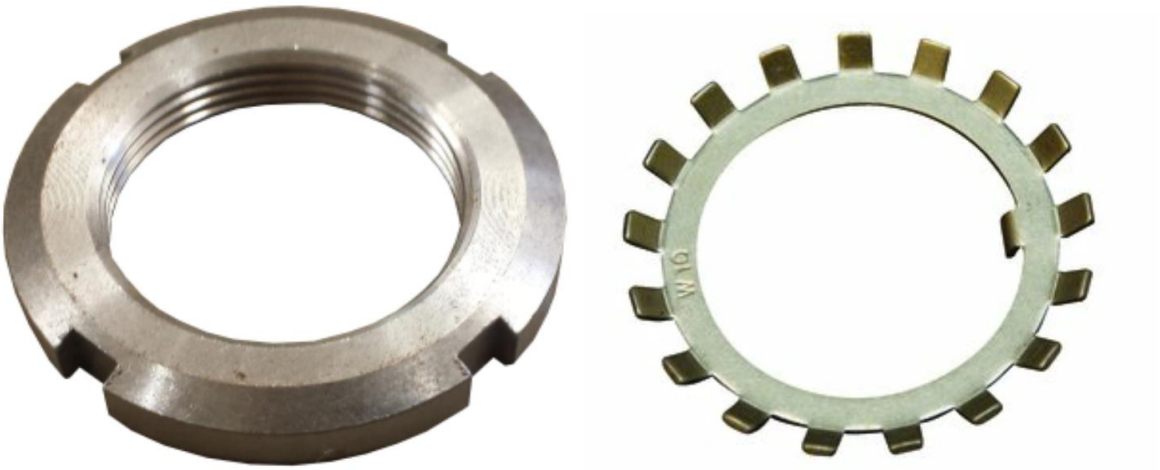


FIG-19 LOCK WASHER AND NUT

BEARING:

Many times agitators are equipped with bearing housing assembly in which depending upon load criteria various bearing are uses. Bearings are use to support the assembly as well as to take up the smooth running of the drive shaft. Bearing reduces the friction of the rotating shaft.

FIG -20 BEARINGS

PROCEDURE WITH BEARING:

1. Bearing uses in the agitators requires high precision of fitting in the housing as well as some of bearing requires very tight fitting to it

2. First of all heat the bearing up to 140℃ then with the help of gloves put it in housing and cooled by air

4.5 ASSEMBLY PROCEDURE

1. Issue and collect the material as per BOM from store.
2. Check all components before start assembly as per drawing.
3. Remove the burrs from the lock nut, shaft thread, and keys.
4. Do the internal threading procedure and clean it with solutions
5. Check the holes & pcd of drive shaft matches with agitators.
6. Put a drive shaft in the motor with the help of smoothening solution and fix it with a appropriate keys.
7. Apply the lock washer, nut for tight fittings of driveshaft.
8. If the agitator is having bearing housing design apply grease tightly in a lantern.
9. Put the motor according to position and cover it with canopy.
10. Change electrical input according to motor configuration.

4.6 QUALITY INSPECTION

Agitator is inspected after whole assembly completes. Following are the points which quality inspector checks:

1. Dimensions of the agitator whether, it is according to size or not mentioned in the latest revised drawing prescribed by design department.
2. Sound checking of the motor by DB meter if necessary.
3. Power consumption of motor by taking the voltage of individual connection i.e. voltages of R, Y, B cable through clamp meter.
4. Checking of parallels by special made jig or fixture.
5. Checking of run outs at various positions like outer flange, inner flange, shaft.
6. If necessary, checking of vibrations by accelerometer.
7. Run the assembly up to designer instruction.
8. Checking of a motor in which mounting position, type of motor, input to output ratios.

5 A PROJECT ASSIGNED AT IDMC Ltd

During the three months of training at IDMC limited, we learn so many practical aspects of mechanical engineering which are untouched during theory classes. In IDMC, we more focus on manufacturing process of pneumatic valves, pumps and agitators. We apply method study to know more about pneumatic valve in our project report. We studied about manufacturing process of pneumatic valve by industrial engineering techniques.

5.1 METHOD STUDY

It is a scientific process to better job design. It studies the existing job process and proposed job process as to identify the appropriate job process which results in efficient and cost effective operations. Therefore, objectives of method study are as follows:

- To study existing work process and proposed work process.
- To find out new methods of increased production and reduction of cost.
- To achieve optimum utilization of resources.

5.2 METHODS TO IDENTIFIED PROBLEM REASONS:

Method study involves following procedures:

- Selection of work to be studied.
- Recording the present method.
- Critical examination of the facts.
- Development of most practical, economic and effective method.
- Installation of new method.
- Maintenance of new method and practices checking

5.2.1 SELECT THE WORK TO BE STUDIED:

There are so many parts in a pneumatic valve but we mainly focused on major components which are made in a IDMC's machine shop which are following:

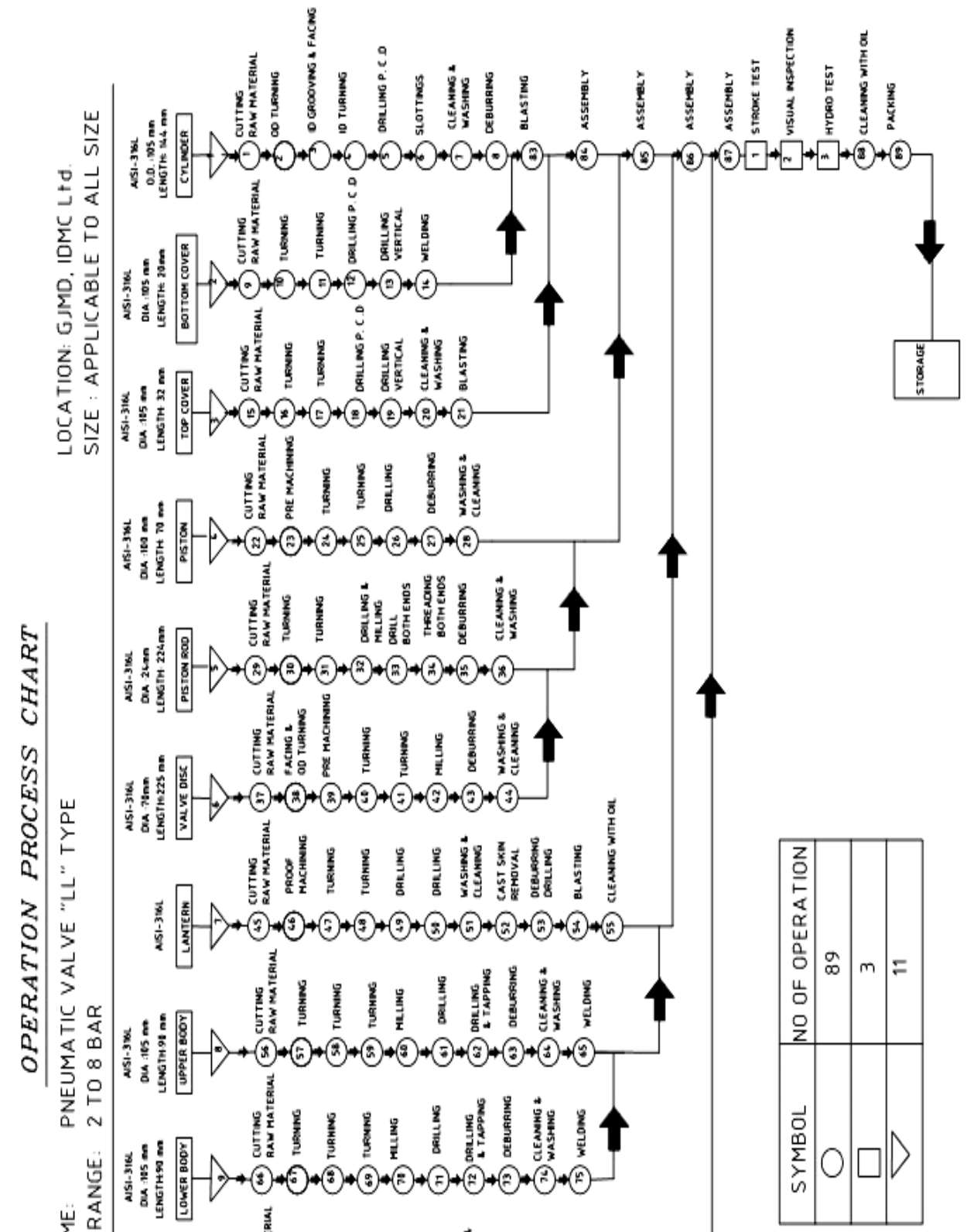
- Upper element/ Lower element
- Lantern
- Bottom cover
- Cylinder
- Top cover
- Piston
- Valve disc
- Piston rod
- Connecting flange
- Controlling cam

5.2.2 RECORDING THE PRESENT METHOD.

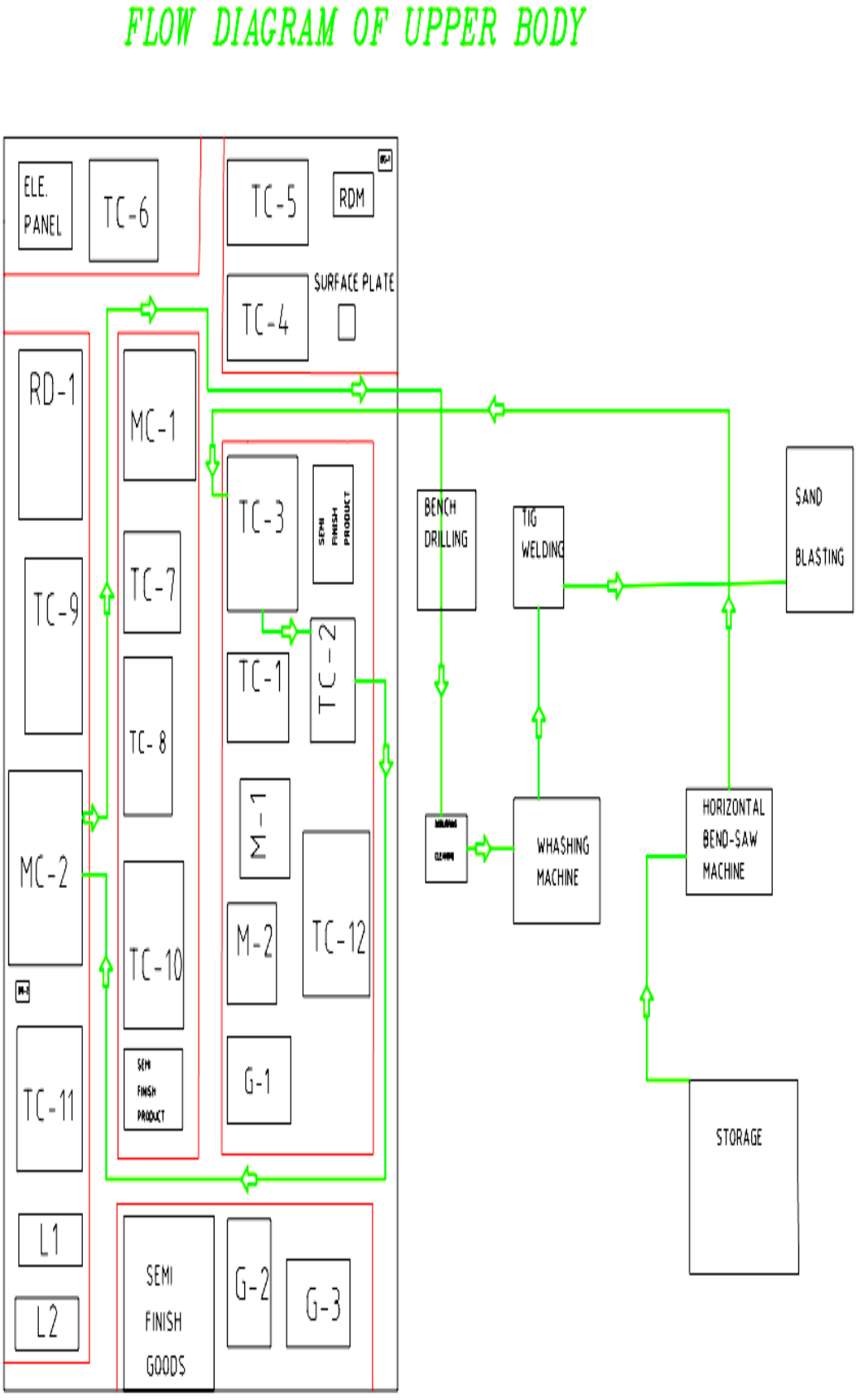
Method study uses formal techniques to record the sequence of activities, the time relationship between different activities, the movement of materials. The recording techniques should be designed with a view to simplify the work and standardize the recording process. For recording the movements, the chief techniques used are: Memo-motion analysis, Micro-motion analysis and Flow diagrams. However, the most commonly used technique used for recording is by using flow charts.

These are classified into three different types, viz. Outline Process Charts, Flow Process Charts and Two Handed Process Chart

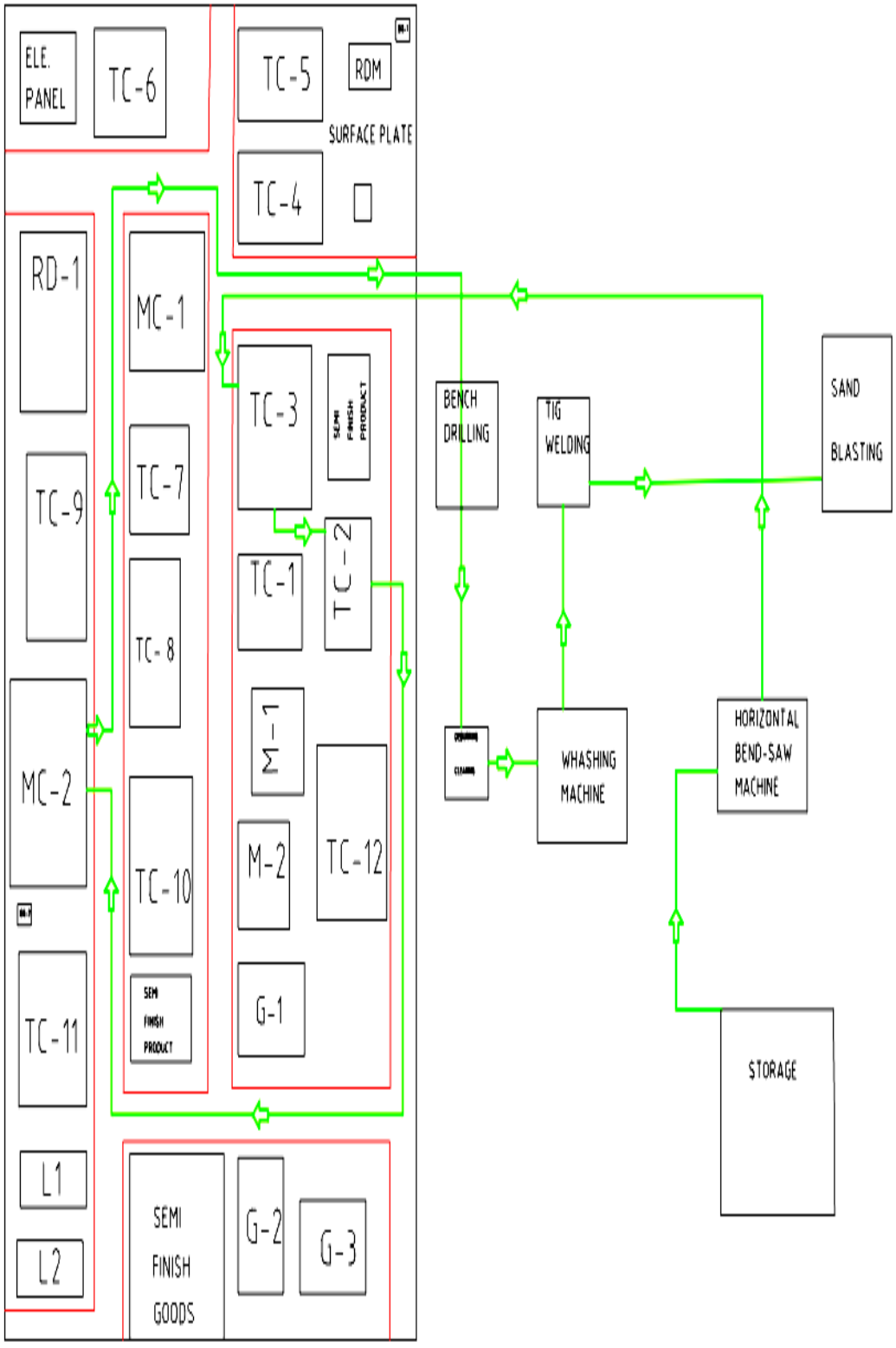
5.2.3 OPERATION PROCESS CHART



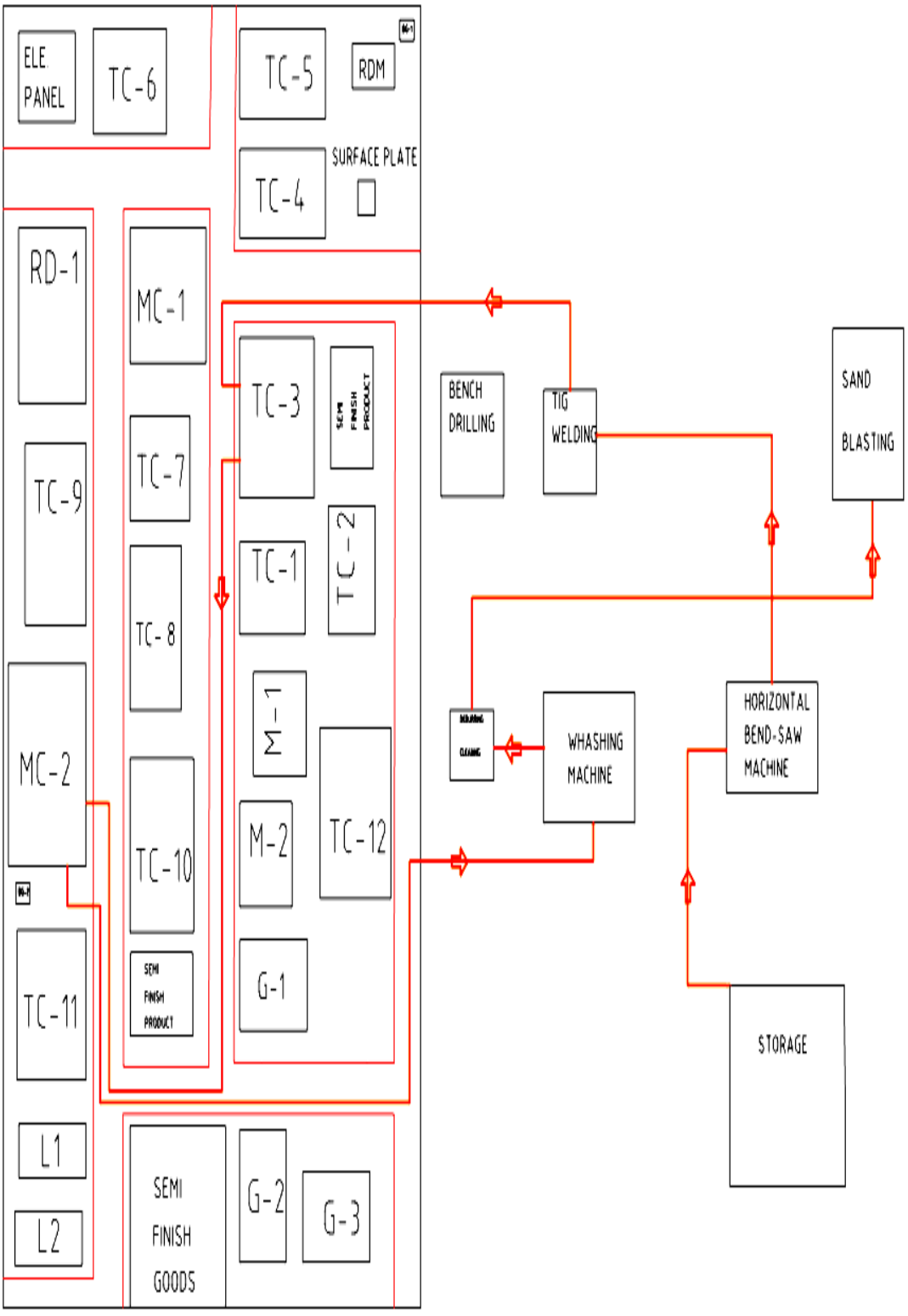
5.2.4 FLOW DIAGRAMS OF PARTS



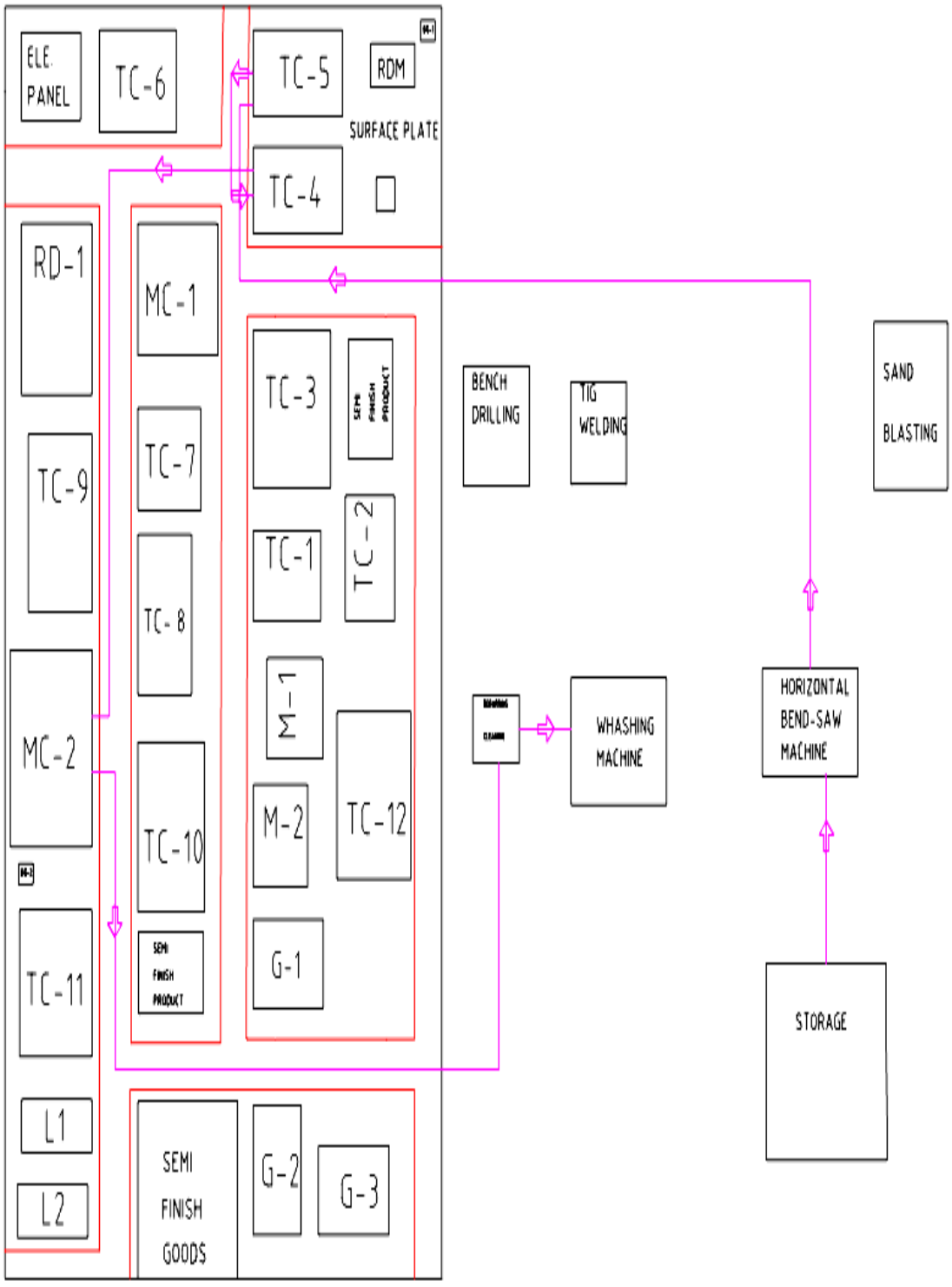
FLOW DIAGRAM OF LOWER BODY



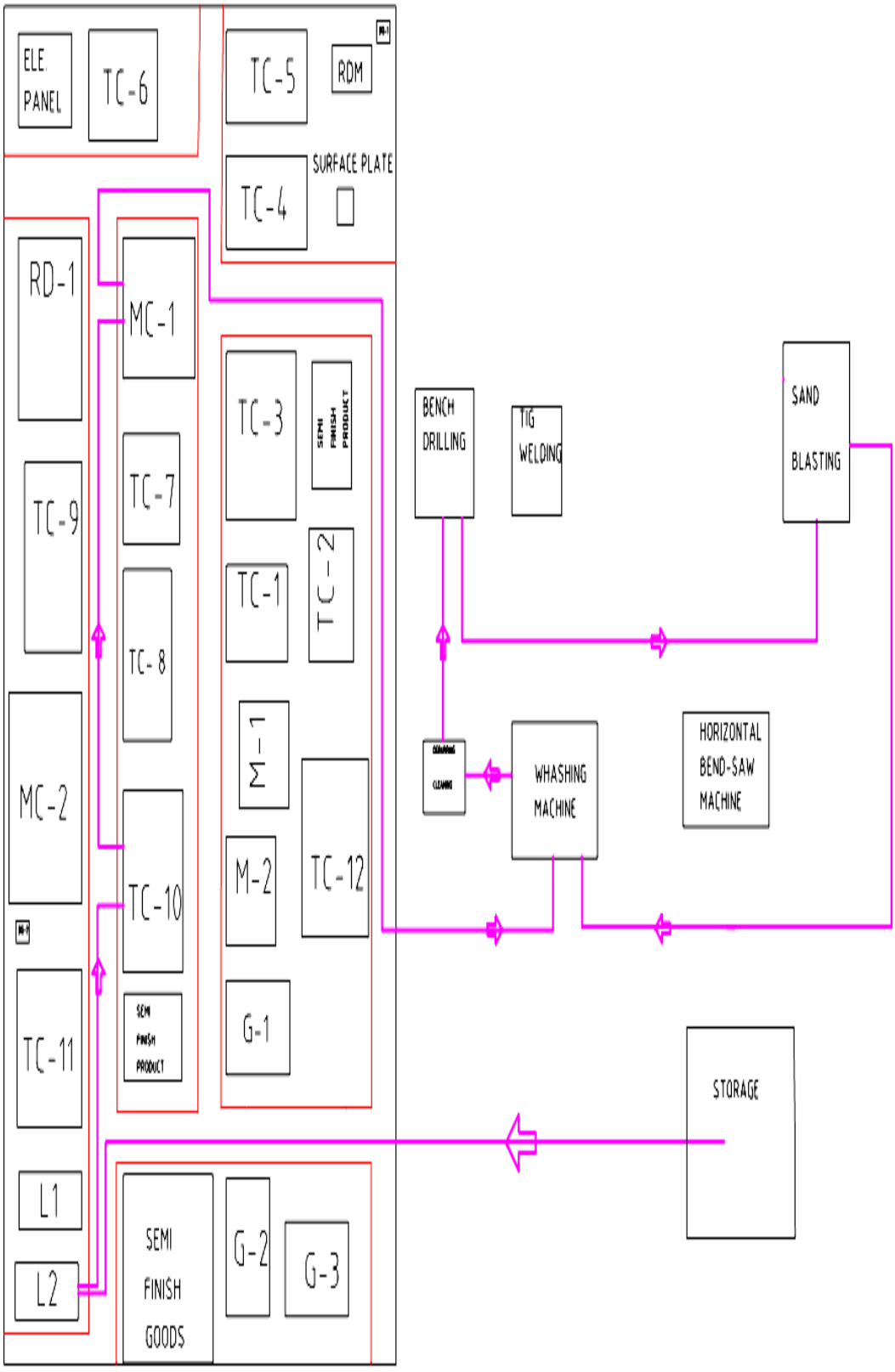
FLOW DIAGRAM OF CYLINDER



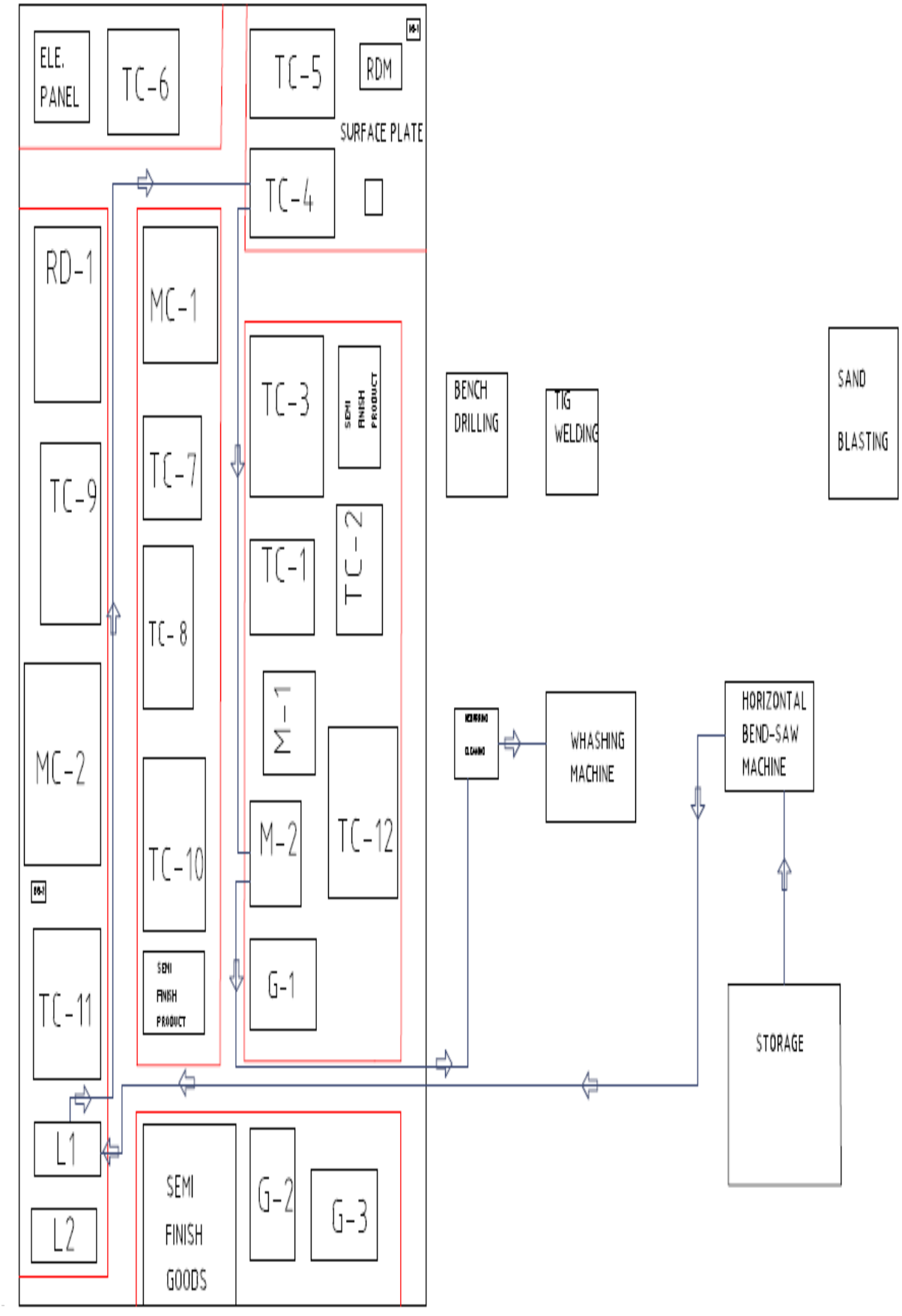
FLOW DIAGRAM OF CONTROLL CAM



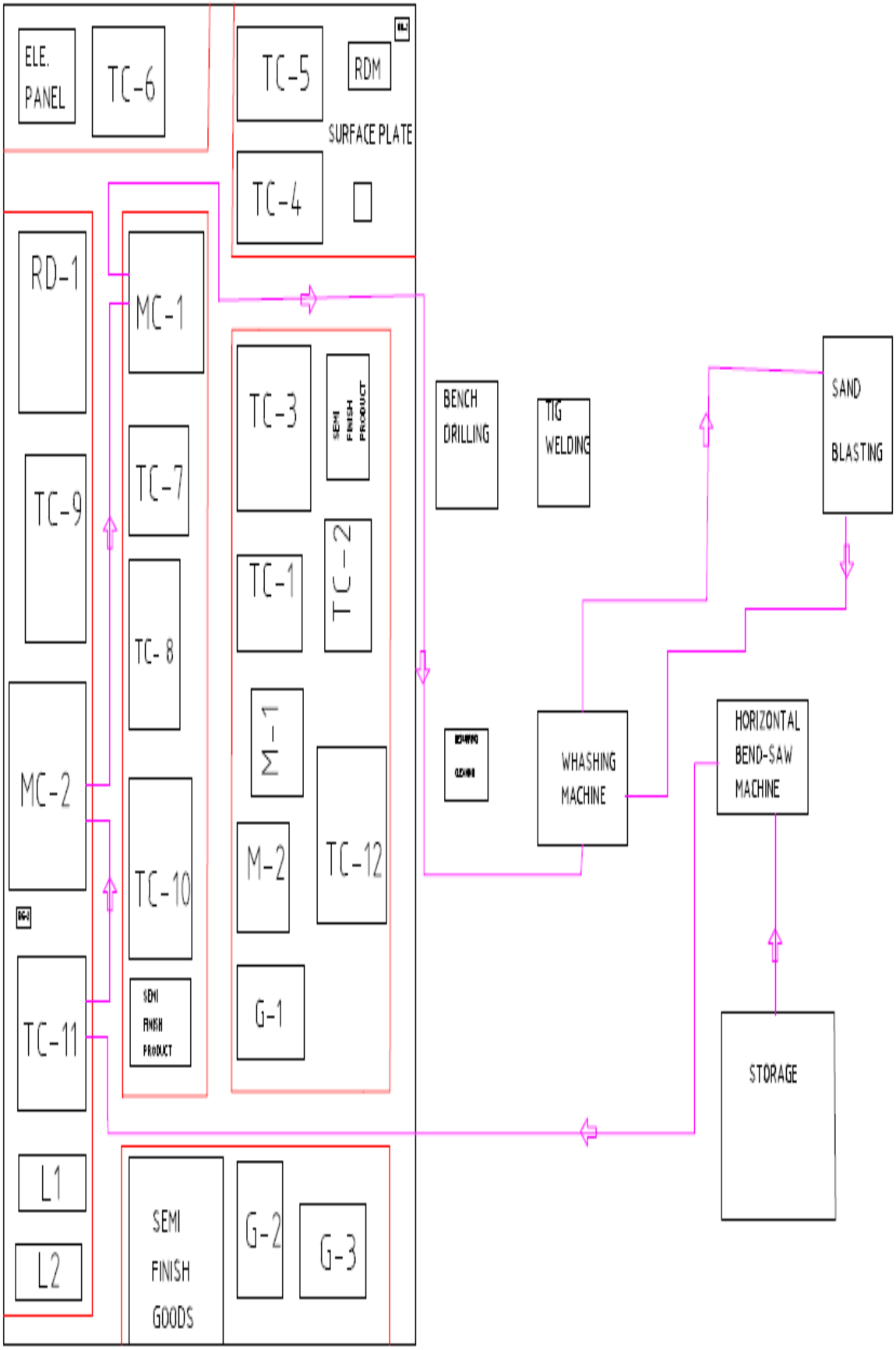
FLOW DIAGRAM OF LANTERN



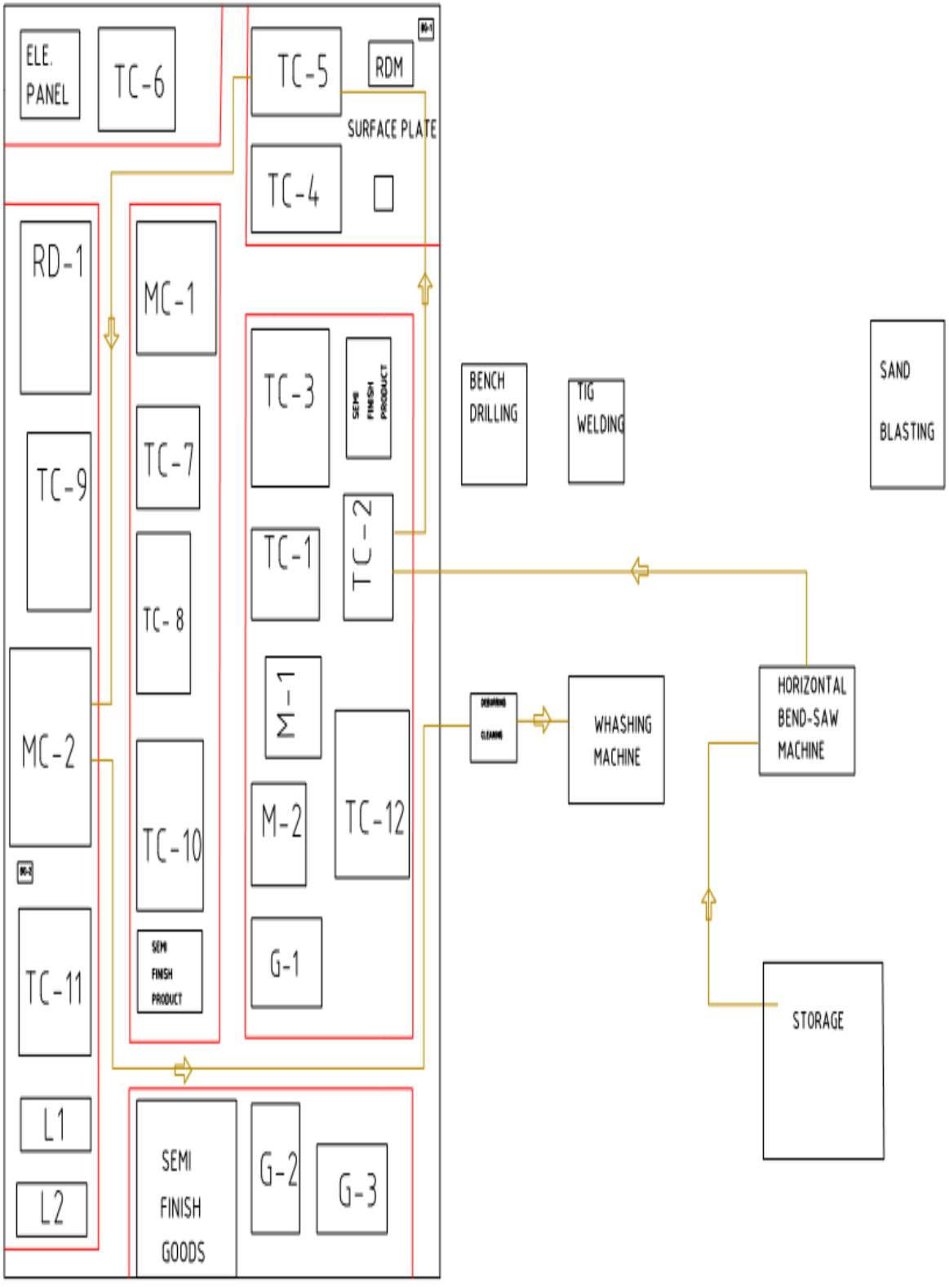
FLOW DIAGRAM OF VALVE DISC



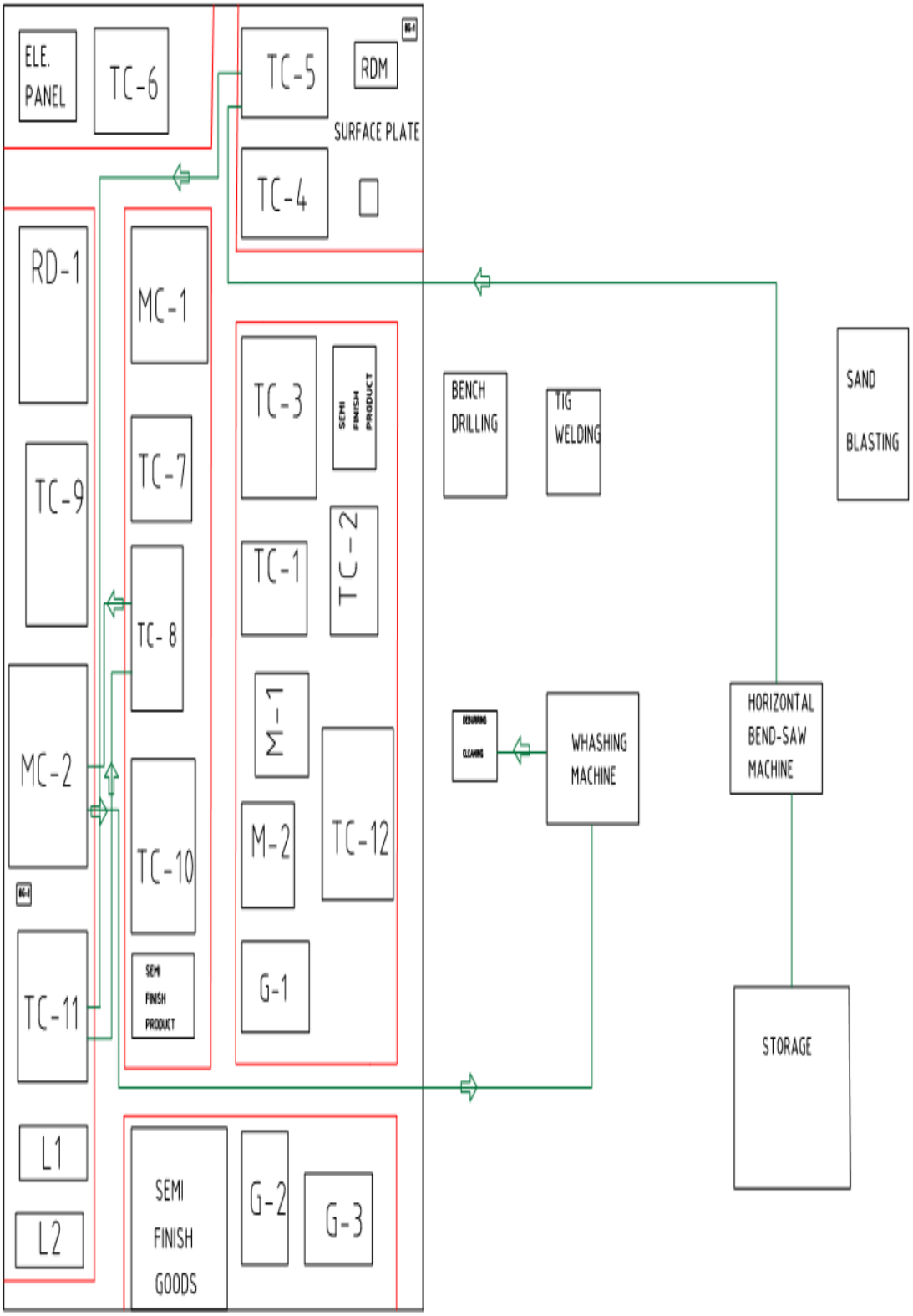
FLOW DIAGRAM OF TOP COVER



FLOW DIAGRAM OF PISTON

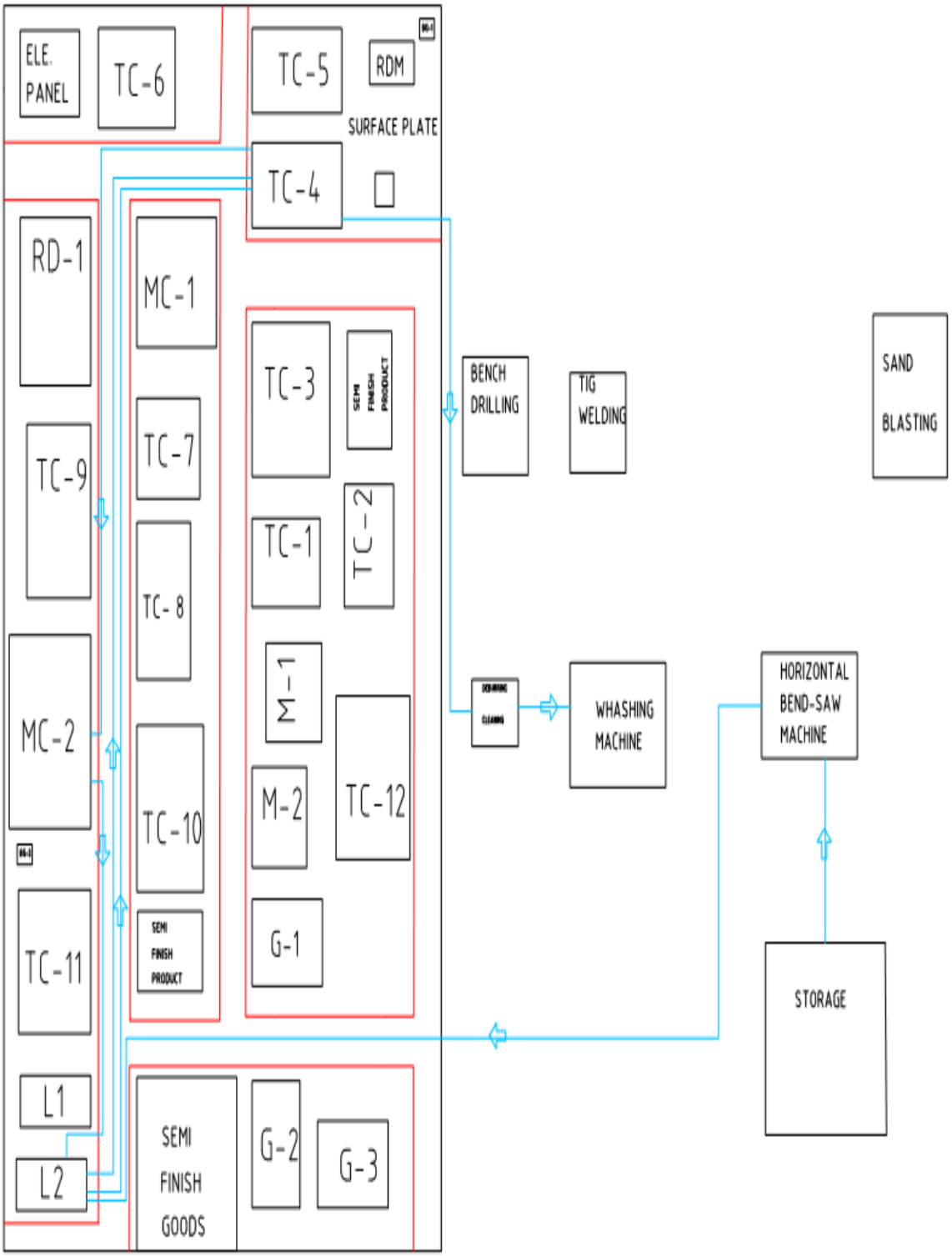


FLOW DIAGRAM OF CONNECTING FLANGE



FLOW DIAGRAM OF PISTON ROD

(PRESENT METHOD)



5.2.5 CRITICAL EXAMINATION OF THE FACTS

We make routing, floor layout, flow-diagrams and operation process chart (opc) for main components of pneumatic valves. At the outcome of a flow diagram we find a back tracking of a piston rod.

There might be any problem with operation sequence of piston rod because unnecessary movement of material is there (flow diagram of present method). We can minimize it by rearrangement of operation sequence as shown in proposed method.

5.2.6 DEVELOPMENT OF MOST PRACTICAL METHOD :

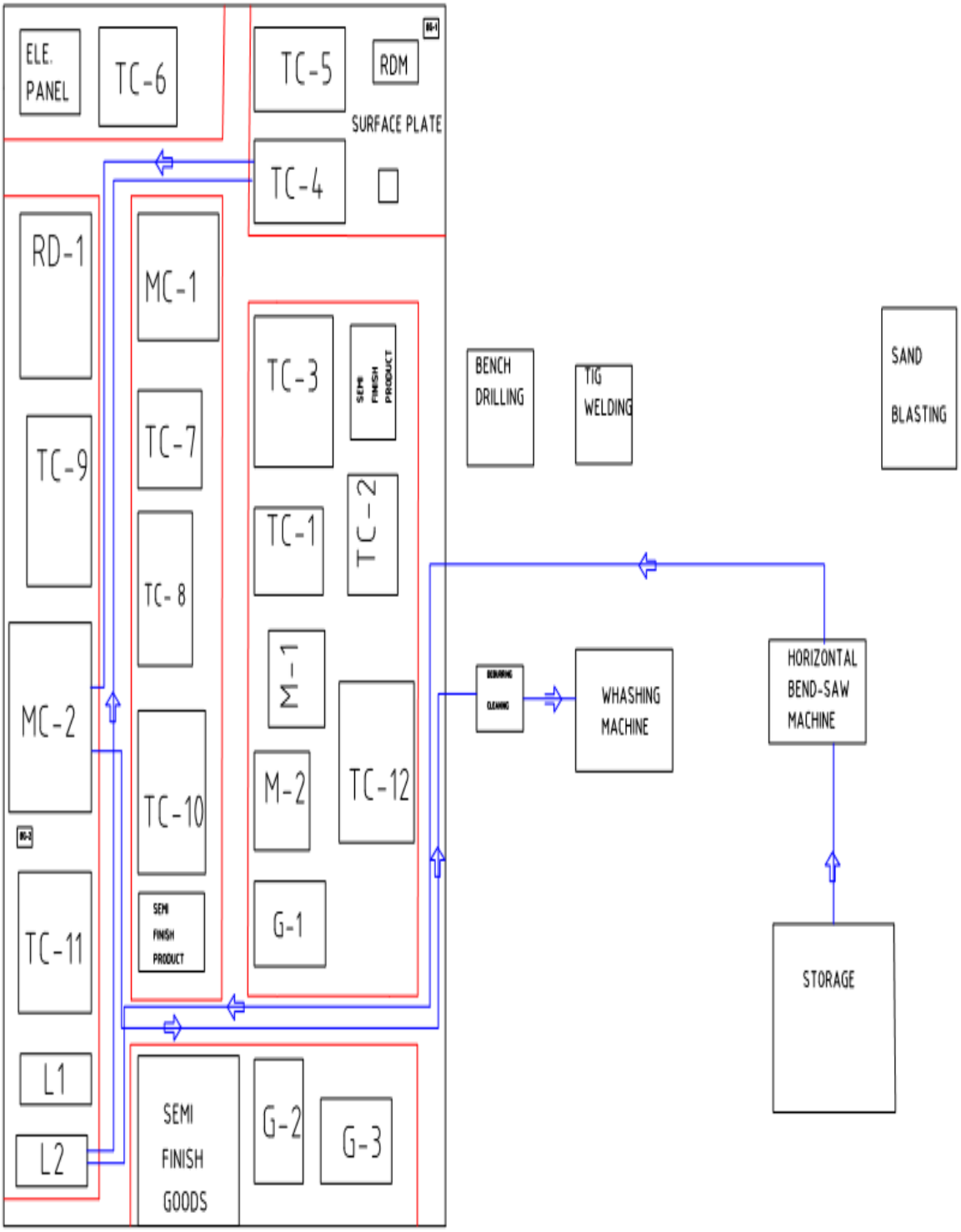
OPERATION SEQEUNCE (PROPOSED METHOD)

MATERIAL : PSTN ROD, 304, PN

QTY : X

OPERATION SEQEUNCE	WORK CENTRE	OPERATION DESCRIPTION
1	LATHE-2	TURNING
2	LATHE-2	DRILL BOTH ENDS
3	HORIZONTAL TURNING CENTRE-4	TURNING
4	HORIZONTAL TURNING CENTRE-4	THREADS BOTH ENDS
5	VERTICAL MILLING CENTRE-2	DRIILING & MILLING
6	MANUAL	DEBURRING
7	CLEANING MACHINE-1	CLEANNING & WASHING

FLOW DIAGRAM FOR PISTON ROD
PROPOSED METHOD



5.2.7 CALCULATION FOR MATERIAL MOVEMENT:

ACCORDING TO PRESENT METHOD:

(FOR EACH COMPONENT)

TOTAL DISTANCE TRAVEL: 97 m

FROM	TO	DISTANCE (m)
LATHE-2	HORIZONTAL TURNING CENTRE-4	29.85
HORIZONTAL TURNING CENTRE-4	VERTICAL MILLING CENTRE-2	23.58
VERTICAL MILLING CENTRE-2	LATHE-2	13.50
LATHE-2	HORIZONTAL TURNING CENTRE-4	29.85

ACCORDING TO PROPOSED METHOD:

TOTAL DISTANCE TRAVEL: 53.5 m

FROM	TO	DISTANCE (m)
LATHE-2	HORIZONTAL TURNING CENTRE-4	29.85
HORIZONTAL TURNING CENTRE-4	VERTICAL MILLING CENTRE-2	23.58

% REDUCTION DUE TO PROPOSED METHOD = $\frac{97-53.5}{97} * 100$

(FOR EACH COMPONENT) = 44.84%

Production of piston rod changes according to requirement, ranges from 300 to 600 per month and ;

If the component is moving in the batches of 10 then total distance travelled by the piston rod is = (300/10)*97 = 2910m and if we reduce according to our proposed method then total distance travelled by component is = (300/10)*53.5 = 1605m

If proposed method is implemented in the routine then we can reduce the material flow path by 45%.

6 REFERENCES:

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