

**SPECIFICATION FOR  
OIL COOLER RADIATOR FOR CONVERTER / TRANSFORMER  
FOR 3 PHASE ELECTRIC LOCOMOTIVES**

**Specification No : CLW/ES/3/0102/E**

**Date of Issue: 01-09-2000**

**Enclosures**

SL. No	Drawing No
1.	CLW/ES/3/SK-1/0102/E
2.	CLW/ES/3/SK-2/0102/E
3.	CLW/ES/3/SK-3/0102/E

**ISSUED BY**

DY.CHIEF ELECTRICAL ENGINEER/D-II  
CHITTARANJAN LOCOMOTIVE WORKS  
CHITTARANJAN – 713331  
Dist: BARDHAMAN (WEST)  
WEST BENGAL (INDIA)

Prepared & Checked By	Approved By
ANIRBAN BASU 2024.07.05 10:53:04 +05'30' SSE-Design	Rakesh Rawal Digitally signed by Rakesh Rawal Date: 2024.07.05 12:57:52 +05'30' Dy.CEE/D-II

**ALTERATION RECORD SHEET**

Amendment Number	Date of Amendment	Page number	Alteration	Descriptions	Authority
01.	20/7/1999	7	A	Drg. sheet No. 6 & 7 have been replaced by new drawing with more details on sheet No. 7	Sd/-
02.	31/08/2000	4, 5, 6, 8, 11, 12, 13	B	(i) Addition of manufacturing, Testing layout/Measurement description of radiator on sheet no 4 & 5. (ii)Some changes have been incorporated in technical data as well as addition of fan data on sheet no.5 & 6. (iii)Addition of oil characteristics in annexure-I on sheet no. 8. (iv)Addition of Characteristic graph of radiator on sheet no. 11. (v)Empty weight of radiator has been changed 350 Kg. instead of 400 Kg. in. the drawing on sheet No. 12. (vi)Addition of test set up of cooling system in drawing on sheet no 13.	Sd/-
03	30-05-2001	12	C	Drawing Sheet No-12 has been replaced by new drawing sheet No-12 with modification of converter radiator side wall on left side flange has been partly cut (150mm x 33mm) vide modification release no-438 dt-25-02-99	Sd/-
04	03-07-2002	12, 7, 14	D	i) Position of taped hole (M6 x 12 deep for fixation of looming bars has been shifted on flange side of converter Radiator to avoid infringement with "L" pipe on sheet no-12. ii)Wire Base Threaded Nut & Bolt has been included in the scope of supply of Oil Cooler Radiator.	Sd/-
05	05-05-2014	4, 5, 6, 7, 8 & 12	E	Specification has been revised with the approval of CEE on dt-05-05-2014. Details of alteration is at sheet no-4, 5, 6, 7, 8 & 12	Sd/-

**Note: Specification has been digitized and all the alteration i.e addition , deletion, modification etc. has been incorporated in the digitized specification.**

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## 1.0 General Description

### SPECIFICATION FOR OIL COOLER RADIATOR FOR CONVERTER /TRANSFORMER.

## 2.0 SCOPE:

This specification applies to Oil Cooler Radiator for Converter and Transformer cooling. The function of Oil Cooler Radiator is to cool the Converter and Transformer for 3 Phase Electric Locomotives.

## 3.0 Climatic and Environmental Condition

- Maximum atmospheric temperatures : Under Sun : +70°C.  
In shade. : +50°C.
- Maximum Humidity : 100% saturation during rainy season.
- Reference site condition :
  - i) Ambient Temperature : max. 55°C , min 0°C
  - ii) Normal Humidity : 60%.
  - iii) Altitude : 1000 m above mean sea level.
  - iv) Rainfall. : Very heavy in certain areas. The locomotive will be designed to permit it's running at 10 kilometer per hour in flood water level of 102 millimeter above rail level.
- Atmosphere during hot weather : Extremely dusty and desert terrain in certain areas.
- Coastal areas : Locomotive and equipment will be designed to work in coastal areas in humid and salt laden atmosphere.
- Vibration.:** The equipment , subsystem and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in IEC 61373 publications unless otherwise prescribed.

## 4.0 STANDARAD : IEC 61373 for Shock and Vibration Test

## 5.0 MANUFACTURING DESCRIPTION -

Oil Cooler Radiator is made of aluminium with two part bolted design construction to enable separation of Converter and Transformer side and to maintain pollution free. Manufacturing process of the radiator involves no-flux vacuum brazing technology. Inside and outside surface of radiator core should be of epoxy coating and of chromatic surface so that corrosion does not take place. Radiator should be built with plain fins to avoid pollution of the radiator and Zinc cromation of the radiator (Dipping process) is compulsory to improve resistance to corrosion. The design of the radiator shall has a wire mesh on the bottom side of the radiator fins to avoid the external hitting.

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## 6.0 TEST LAYOUT / MEASUREMENTS DESCRIPTION :

The test set up of cooling system for testing of radiator shall be installed as per drawing no. **CLW/ES/3/SK-2/0102/E**. To simulate the additional pressure losses in the inlet and outlet areas of the cooling system in the locomotive, the cooling system is installed on a special scaffold with adjustable ports for regulating the airflow.

### 6.1 COOLING PERFORMANCE OF THE CONVERTER COOLER:

To simulate the power loss in the converter, thermal energy is generated in a primary circuit by means of hydraulic drive unit and a pressure plate. The energy is transferred to the cooling circuit by means of fluid / fluid heat exchanger. A pump circulates the coolant through the cooling circuit. Thus the coolant is pumped through the converter radiator where the thermal energy is dissipated to ambient air by forced convection. The pipe work between heat exchanger and cooling system comprises various measuring points where the temperature, the pressure and volume flow are registered.

The inlet and outlet of the cooling system are fitted with four Pt. 100 precision resistors each (designed in four-wire technology) that measure the coolant temperature at these points. The cooling air inlet and cooling air outlet are fitted with eight thermocouple units of type K each to determine the cooling air temperature at these points, for measuring points refer schematic diagram on sheet No. 9.

### 6.2 COOLING PERFORMANCE OF TRANSFORMER COOLER :

To simulate the power loss in the transformer, thermal energy is generated in a primary circuit by means of hydraulic drive unit and a pressure plate. The energy is transferred to the cooling circuit by means of a fluid / fluid heat exchanger. A pump circulates the coolant through the cooling circuit. Thus the coolant is pumped through the transformer radiator where the thermal energy is dissipated to ambient air by forced convection. The pipe work between heat exchanger and cooling system comprises various measuring points where the temperature, the pressure and volume flow are registered.

The inlet and outlet of the cooling system are fitted with four Pt. 100 precision resistors each (designed in four-wire technology) that measure the coolant temperature at these points. The cooling air inlet and cooling air outlet are fitted with eight thermocouple units of type K each to determine the cooling air temperature at these points. For measuring points refer schematic diagram on sheet No. 10.

## 7.0 TECHNICAL DATA :

(A)

PARAMETER	UNIT	CONVERTER	TRANSFORMER
Heat to be dissipated	KW	116	120
Air inlet temperature	°C	47	62.8
Ail outlet temperature	°C	62.6	76.2
Oil inlet temperature	°C	68.2	84.5
Oil outlet temperature	°C	64	80
Oil flow	LPM	960	1000
Pressure drop oil side	Bar	0.6 to 0.66 (max.)	0.6 to 0.76 (max.)

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Oil type		Shell Diala DX (for Oil details refer annexure 1)	Shell Diala DX (for oil details refer annexure 1)
Altitude a. s. i	M	0 to 1000	0 to 1000
Humidity	%	60	60
Humidity maximum	%	100	100
Cooling air mass flow	Kg/Sec.	8.8	8.8

**(B) Size of fins / number of tubes of the Radiator:** The radiator consists of 63 tubes and 64 rows of fins.  
The fin height is 12 mm, the fin to fin distance is 2 mm. This is for guidance only.

**(C) Weight of the Radiator:** The empty weight of the radiator is 400 kg  $\pm$  5%

**(D) Tech. Data for Fan:**

Cooling air mass flow	8.8 Kg/Sec
Mass flow density	1.076 Kg/m <sup>3</sup>
Resistance air side cooler section total	800Pa
Resistance air side - Filtration	780Pa
-Air Duct filter to oil cooling unit	85 Pa
-Air Outlet	65 Pa
-Reserve	50 Pa
Resistance Air side stat. total	1780 Pa
Fan speed	2920 r.p.m
Fan power at Spec. 47 °C / 160 m	23.5kW

**(E) Colour** - Stone Grey

**(F)** Tenderer should furnish theoretical calculation for heat dissipation before manufacture of prototype .

**8.0 Test Programs**

Sl. No.	Test Description	Type Test	Routine Test
1.	Visual and Dimension checking shall be as per the approved OGA drawing. OGA drawing will be approved by CLW or Specification drawing.	Y	Y
2.	Heat Run Test	Y	No
3.	Leakage / Pressure test shall be conducted at 5 bar test pressure for minimum one hour. There should not be any leakage at the end of the test period.	Y	Y
4.	Air Delivery Test	Y	No
5.	Oil Pressure Drop Test	Y	Y

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6.	<b>Weighment test</b> Weight of the complete Radiator without coolant shall be 400 Kg $\pm$ 5%.	Y	Y
7.	<b>Shock and Vibration Test.</b> Shock and vibration test shall be conducted as per IEC:61373(latest). Category 1 (body mounted)	Y	No
8.	Leakage / Pressure test after Shock and Vibration. Test shall be conducted at 5 bar test pressure for minimum one hour. There should not be any leakage at the end of the test period.	Y	No

**9.0 Drawing:** - Dimensional drawing of Oil Cooler Radiator for Converter / Transformer cooling is shown as per - Drg. No. CLW/ES/3/SK-1/0102/E and test layout is shown as per Drg . No. CLW/ES/3/SK-2/0102/E.

**10.0 QUALITY ASSURANCE:** Quality assurance should be as per ISO 9000.

**11.0 TECHNICAL DOCUMENTS TO BE SUPPLIED BY THE SUPPLIER:**

The following documents shall be supplied by the supplier as a part of the contract.

- Maintenance manual - One per Unit
- Detailed drawings

**12.0 Label & Marking:**

- Make
- Year and Month of Mfg.
- Sl. No.
- Trade Mark if any.
- Drg. No.
- Order No.

**13.0 Hardware:**

- Standard Hardware and Fasteners should be of CLW/BLW/RDSO approved source only to be used.
- Firm should supply 16 nos/ Loco Wire Base Threaded Nut and Bolt as per drawing no-CLW/ES/3/SK-3/102/E.

**14.0 Warranty /Guarantee:** The supplier must give a clear guarantee of **60** Month from the date of supply or **54** Months from the date of commissioning whichever period is earlier. If any defect is noticed or failure occurs during this period due to defective material or workmanship or faulty design, the supplier shall have to give replacement free of cost.

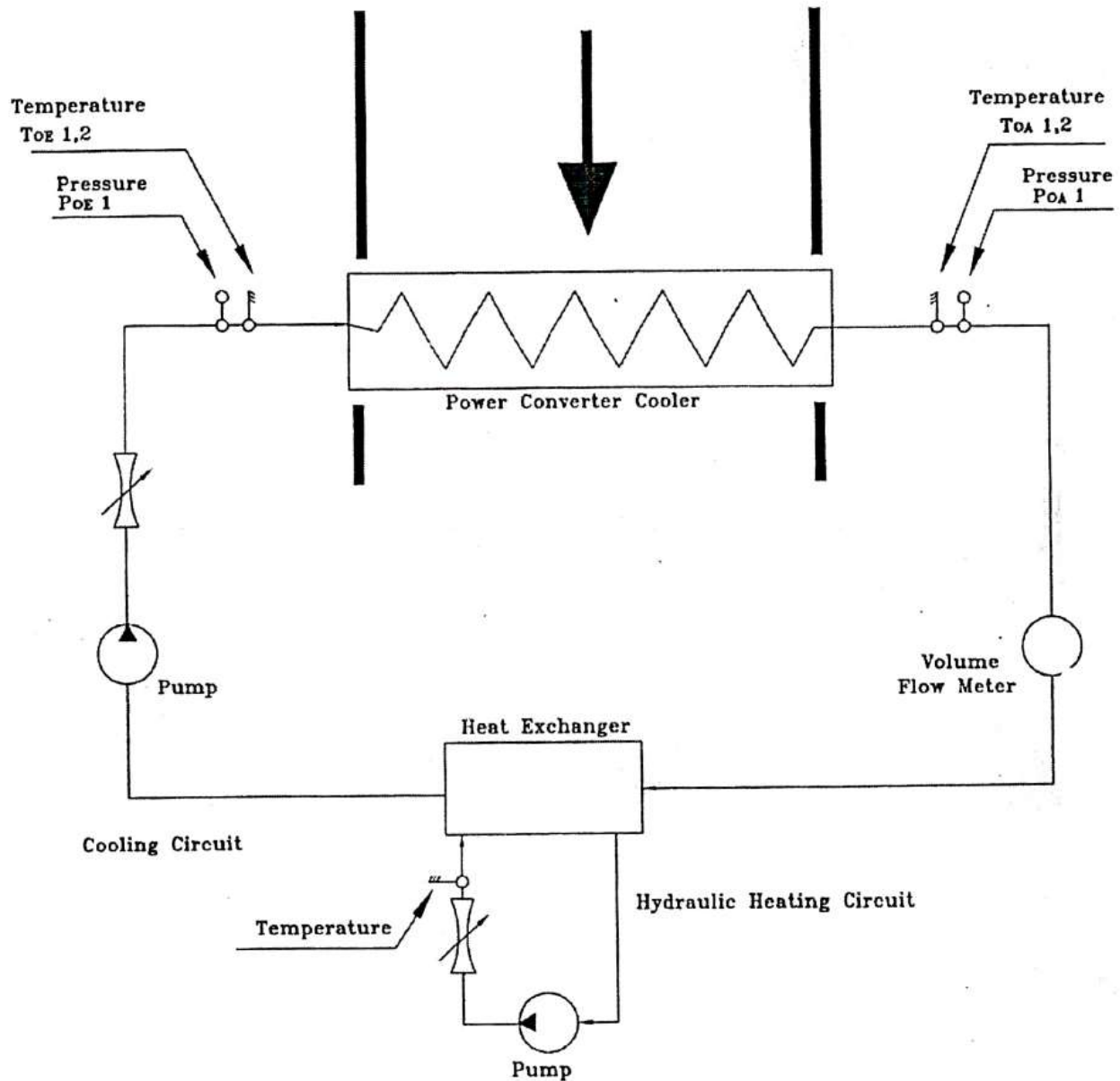
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## 15.0 CHARACTERISTICS OF OIL (SHELL DIALA DX)

SL. NO.	PARAMETER	UNIT	ACCORDING TO IEC 60296 CLASS II
1.	Appearance		Clear, free from suspended and collected impurities.
2.	Density at 20°C	gm/cm <sup>3</sup>	Max. 0.895
3.	Flash point	°C	Min 130
4.	Pour point	°C	Max. - 45
5.	Kinematic viscosity at 40°C	mm <sup>2</sup> /s	Max. 11.0
6.	Kinematic viscosity at -30°C	mm <sup>2</sup> /s	Max. 1800
7.	Neutralization value	mgKOH/g	0.03
8.'	Corrosive sulphur content		Non-corrosive
9	Breakdown Voltage	kV	Min 30
10.	Dielectric loss factor at 90°C		Max. 0.005
11.	IEC ageing process (164/100°C) Neutralization value Impurities Dielectric loss factor at 90°C	mg KOH/g g/ 100g	Max. 0.4 Max. 0.1 Max. 0.15

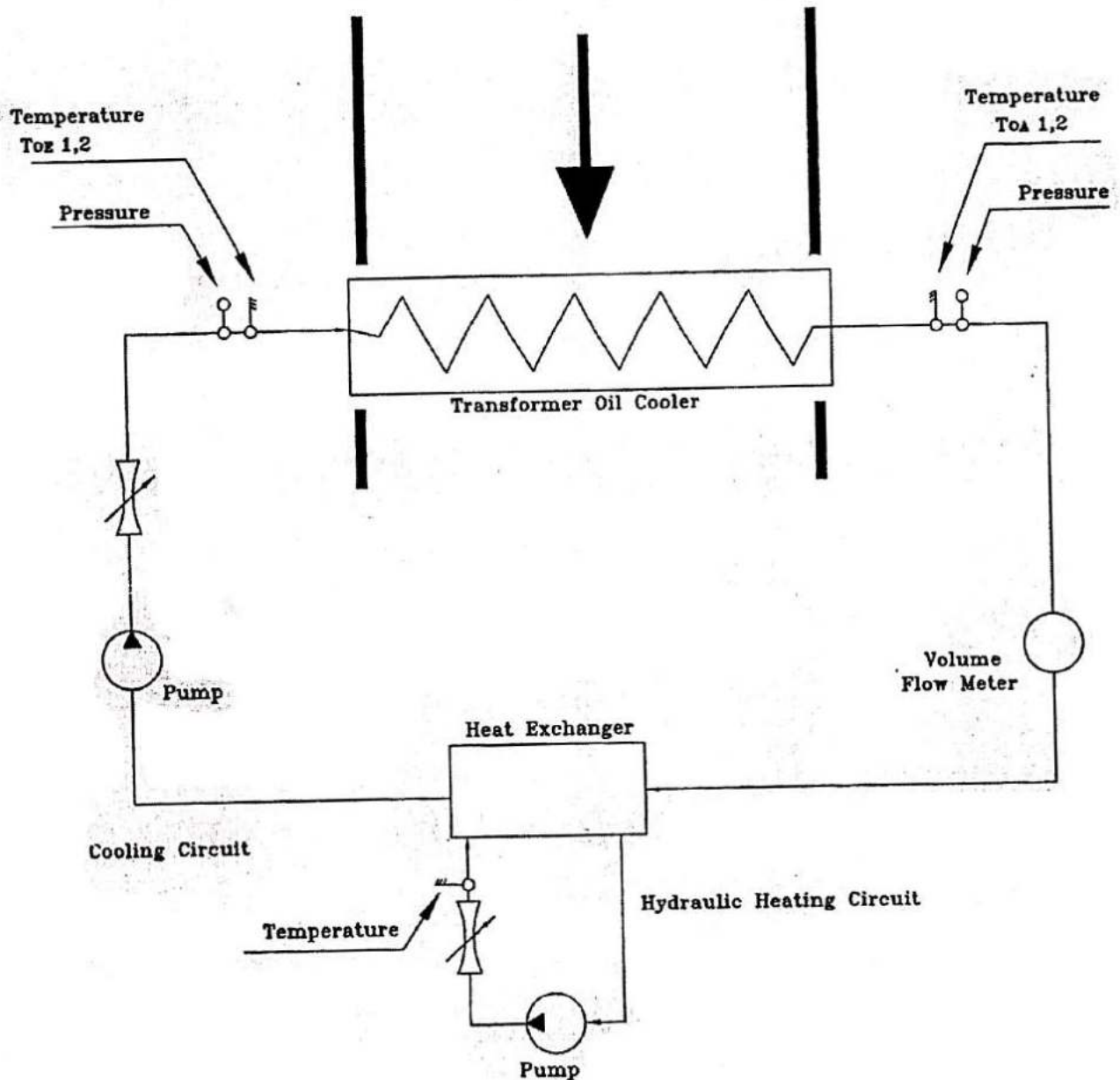
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### Measuring Point in Circuit 1 (Power Converter)

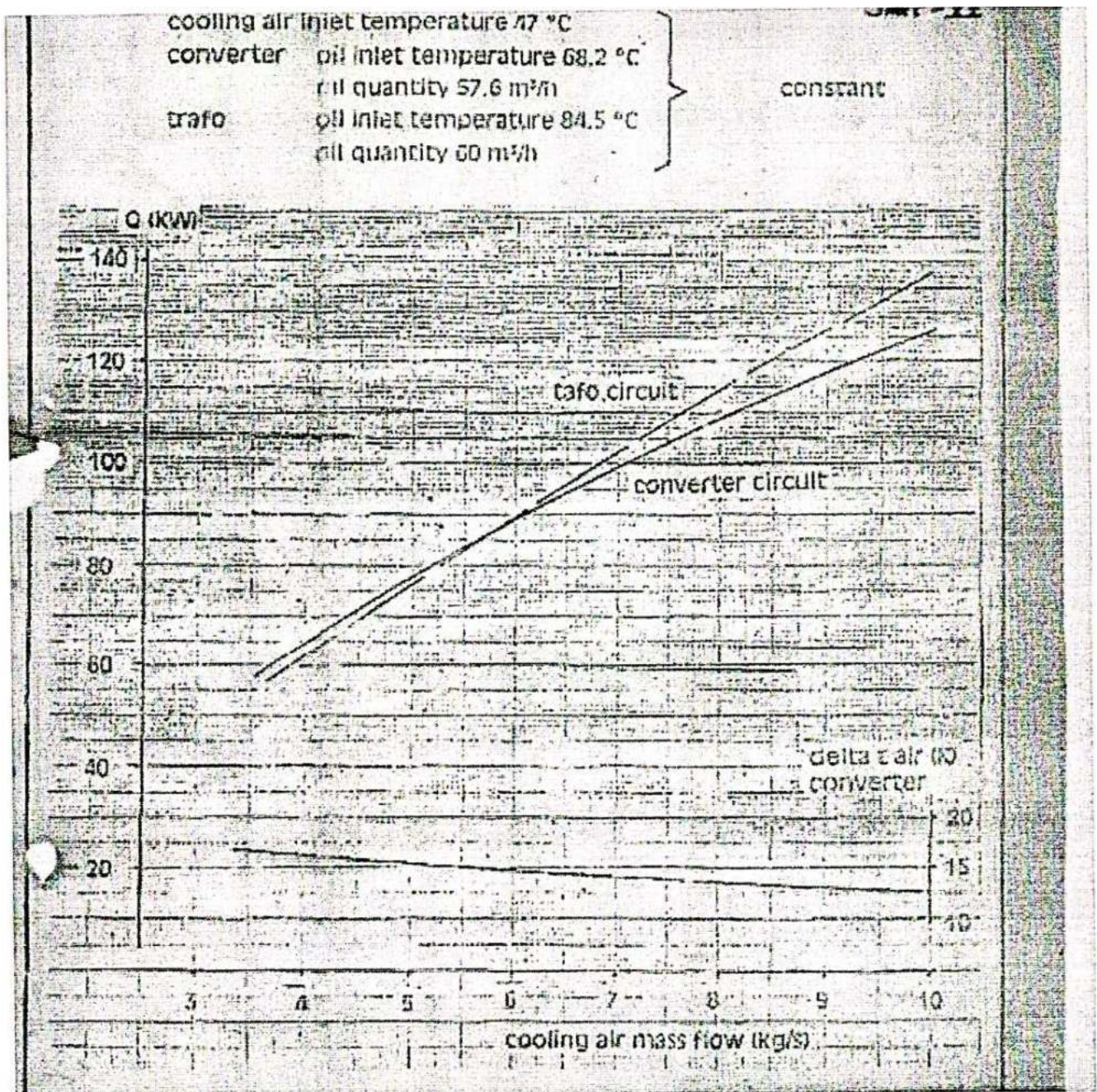


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SSE-Design		Dy.CEE/D-II	

### Measuring Point in Circuit 2 (Transformer)



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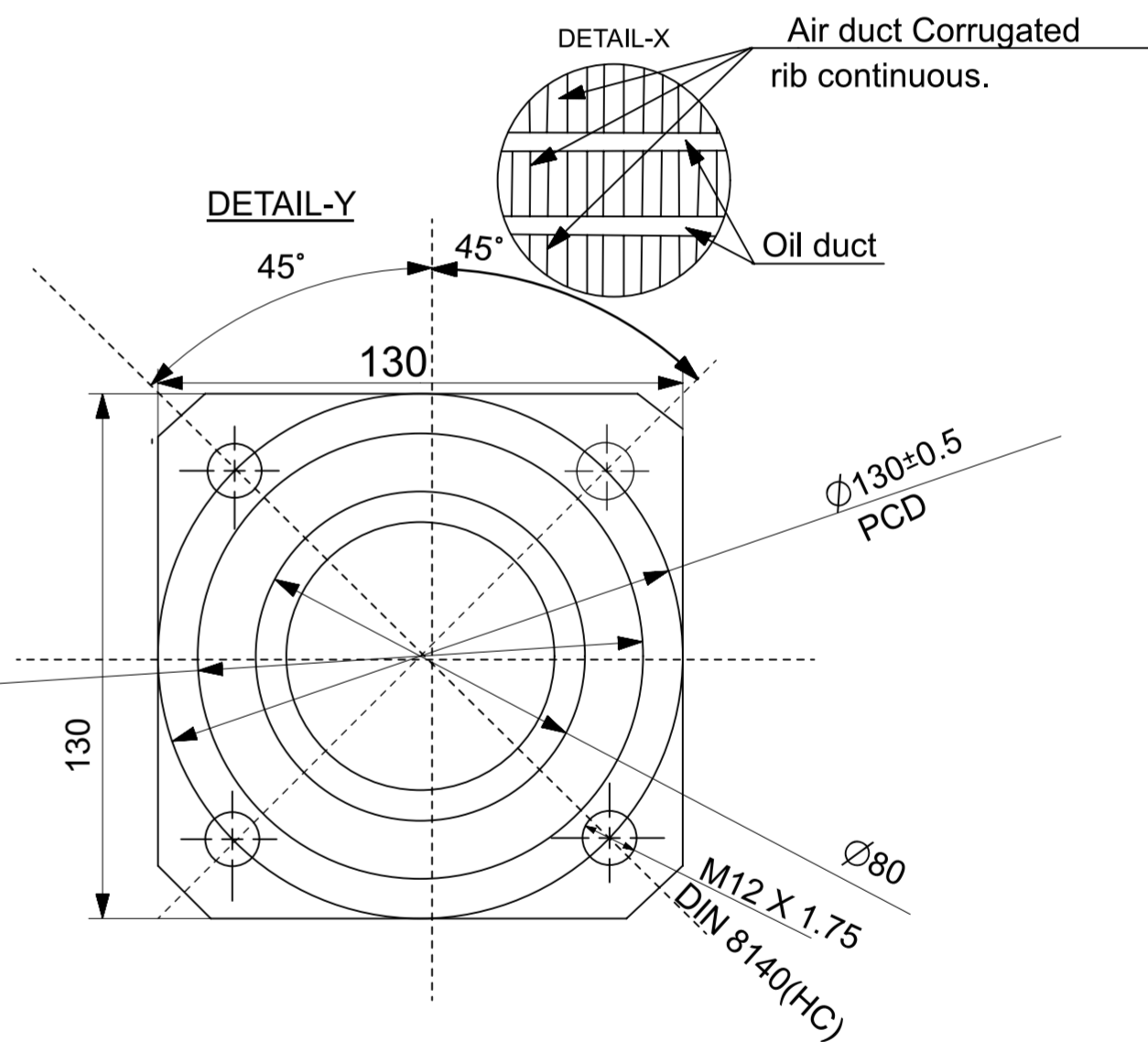
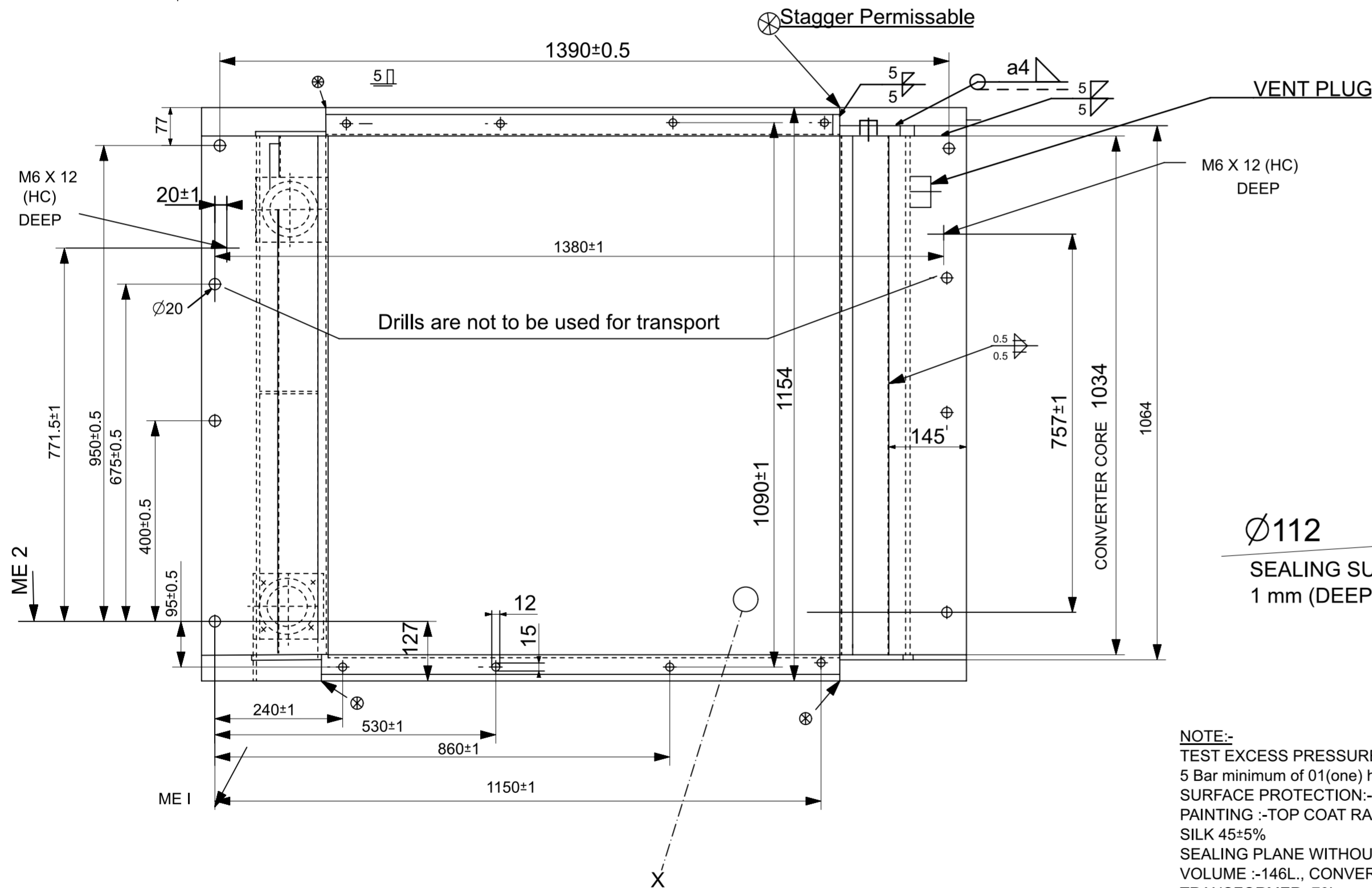
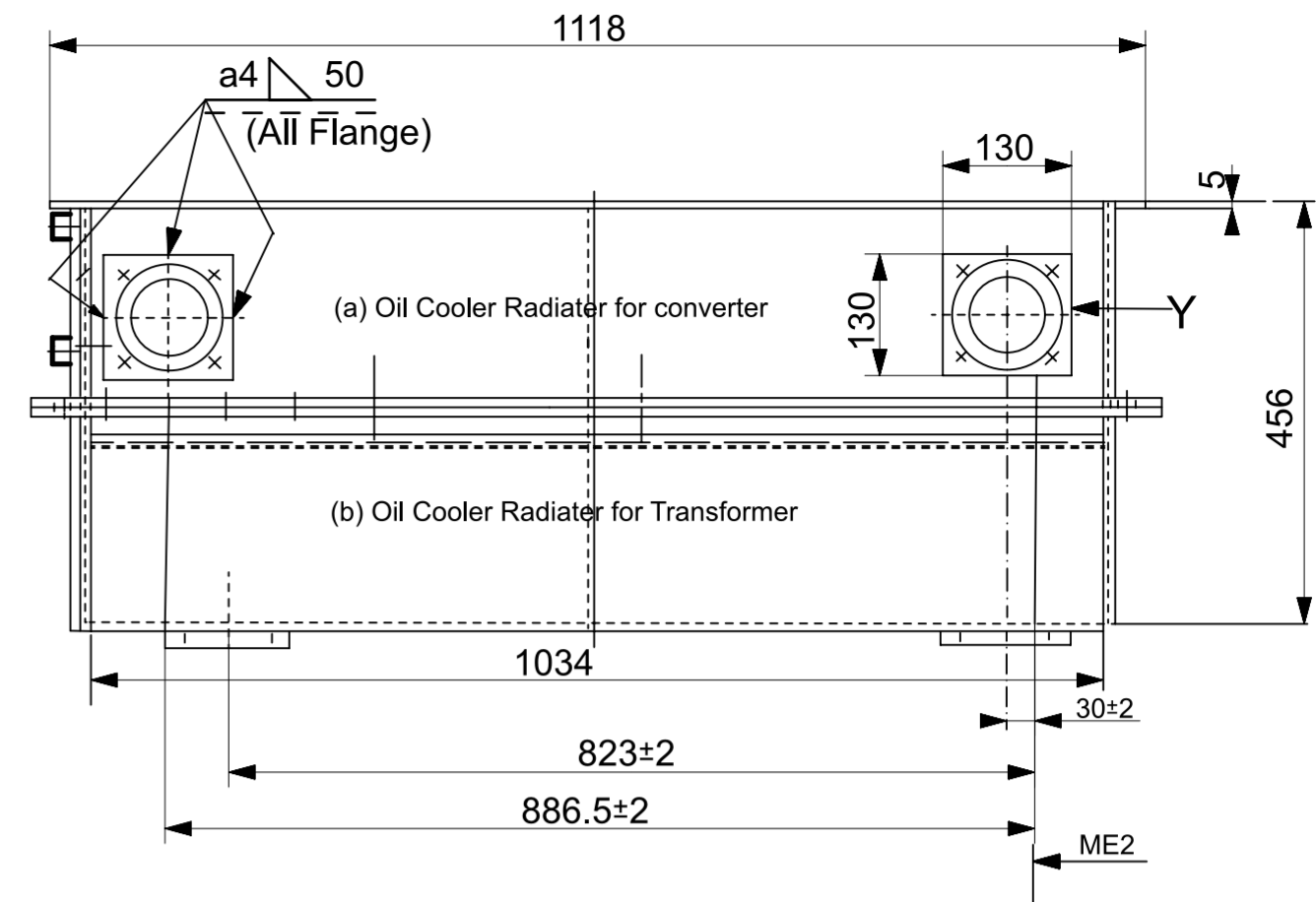
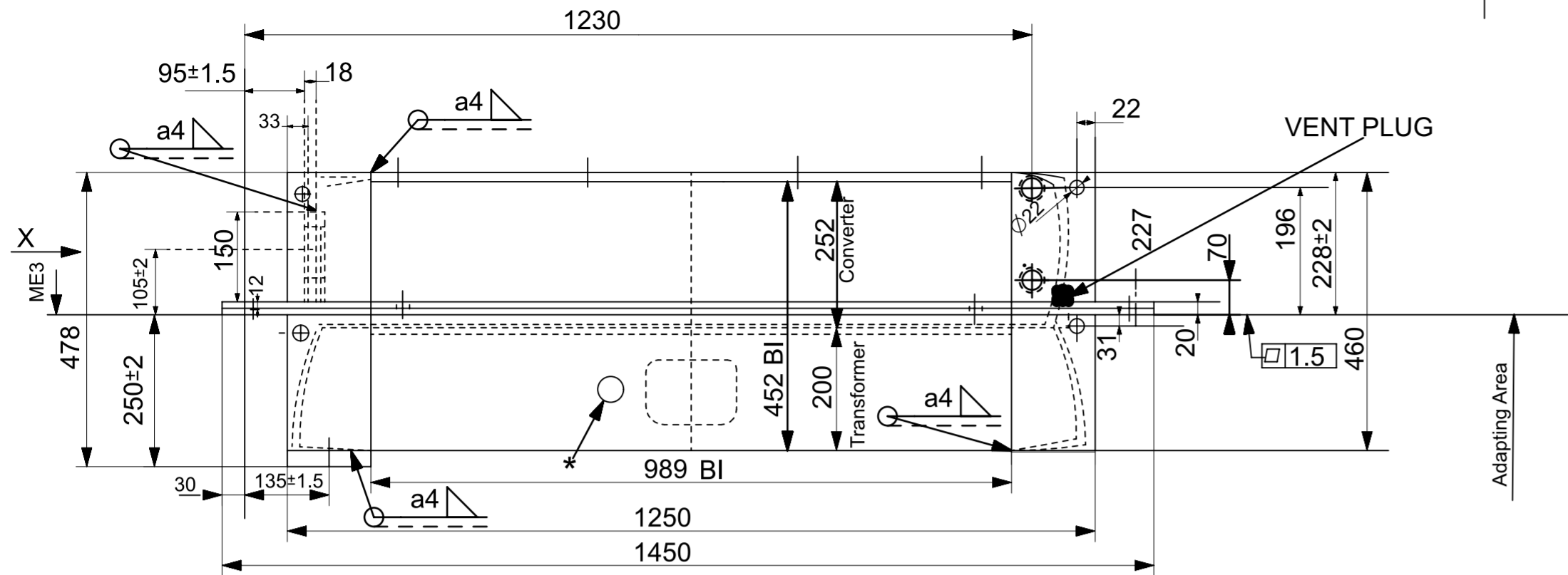


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ANIRBAN BASU  
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SSE-Design

Approved By

Rakesh  
Rawal  
Digitally signed  
by Rakesh Rawal  
Date: 2024.07.05  
13:02:06 +05'30'  
Dy.CEE/D-II



NOTE:-  
TEST EXCESS PRESSURE :-  
5 Bar minimum of 01(one) hour  
SURFACE PROTECTION:- EPOXY-RESIN  
PAINTING :-TOP COAT RAL 7030 STONE GREY  
SILK 45+5%  
SEALING PLANE WITHOUT EPOXY-RESIN)  
VOLUME :-146L., CONVERTER:-76L  
TRANSFORMER:-70L  
FOR TRANSPORT COOLER FLANGES HAVE TO BE CLOSED  
ME:-WORKING PLANE  
QTY./LOCO :-2 NOS. ,C&D NO. :-T020/010.

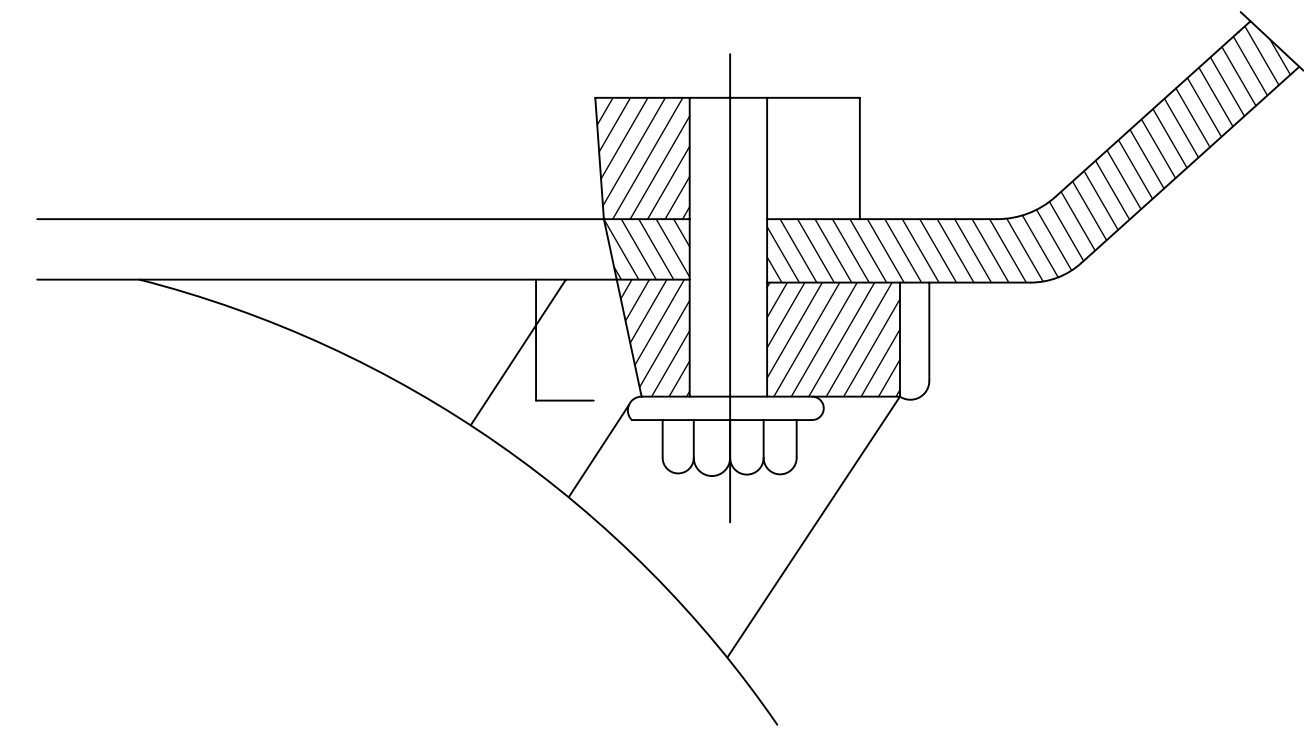
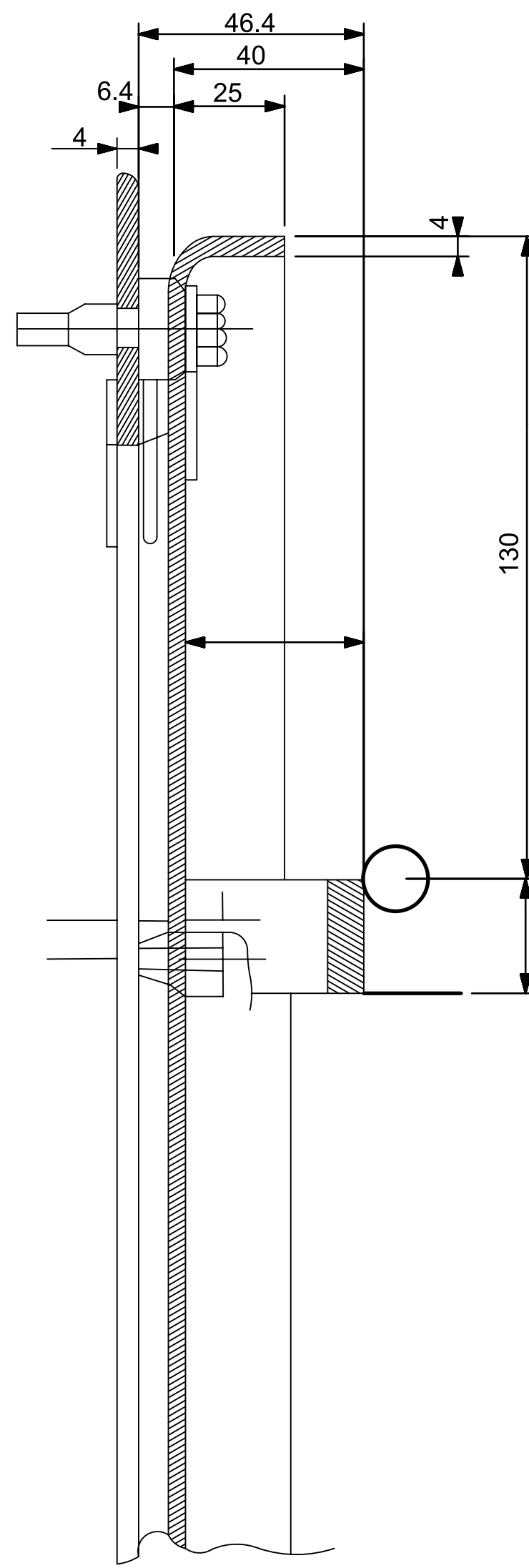
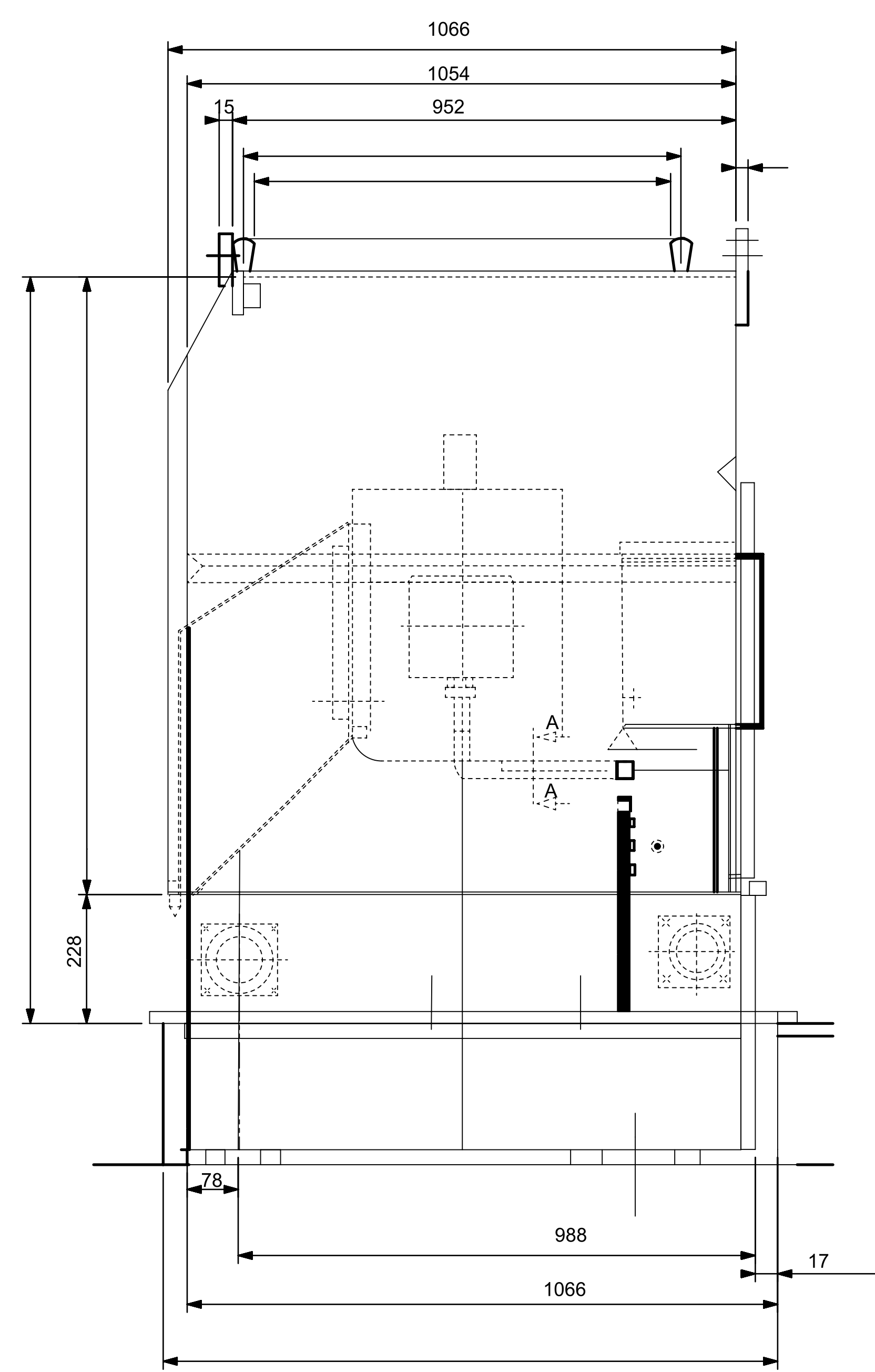
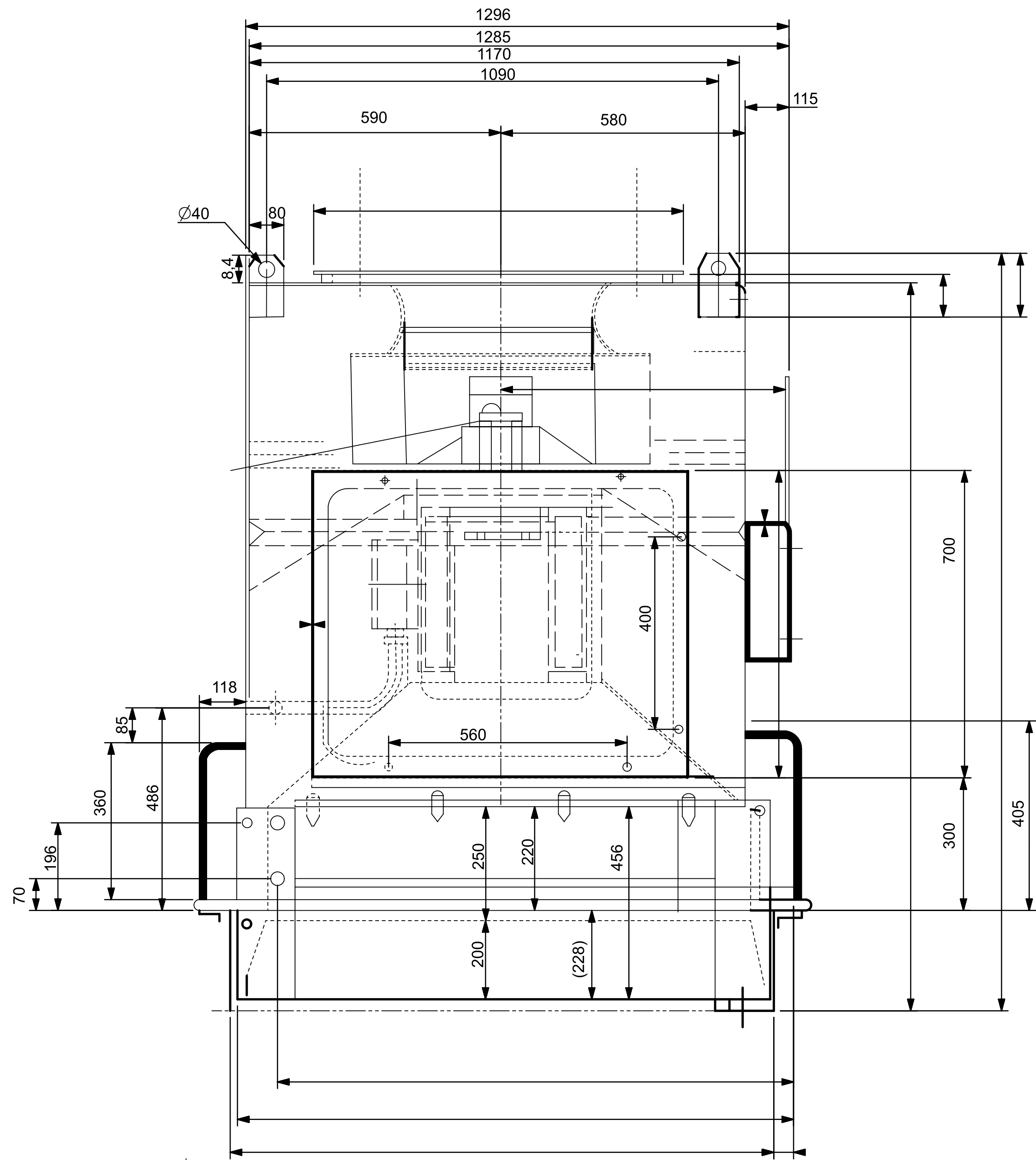
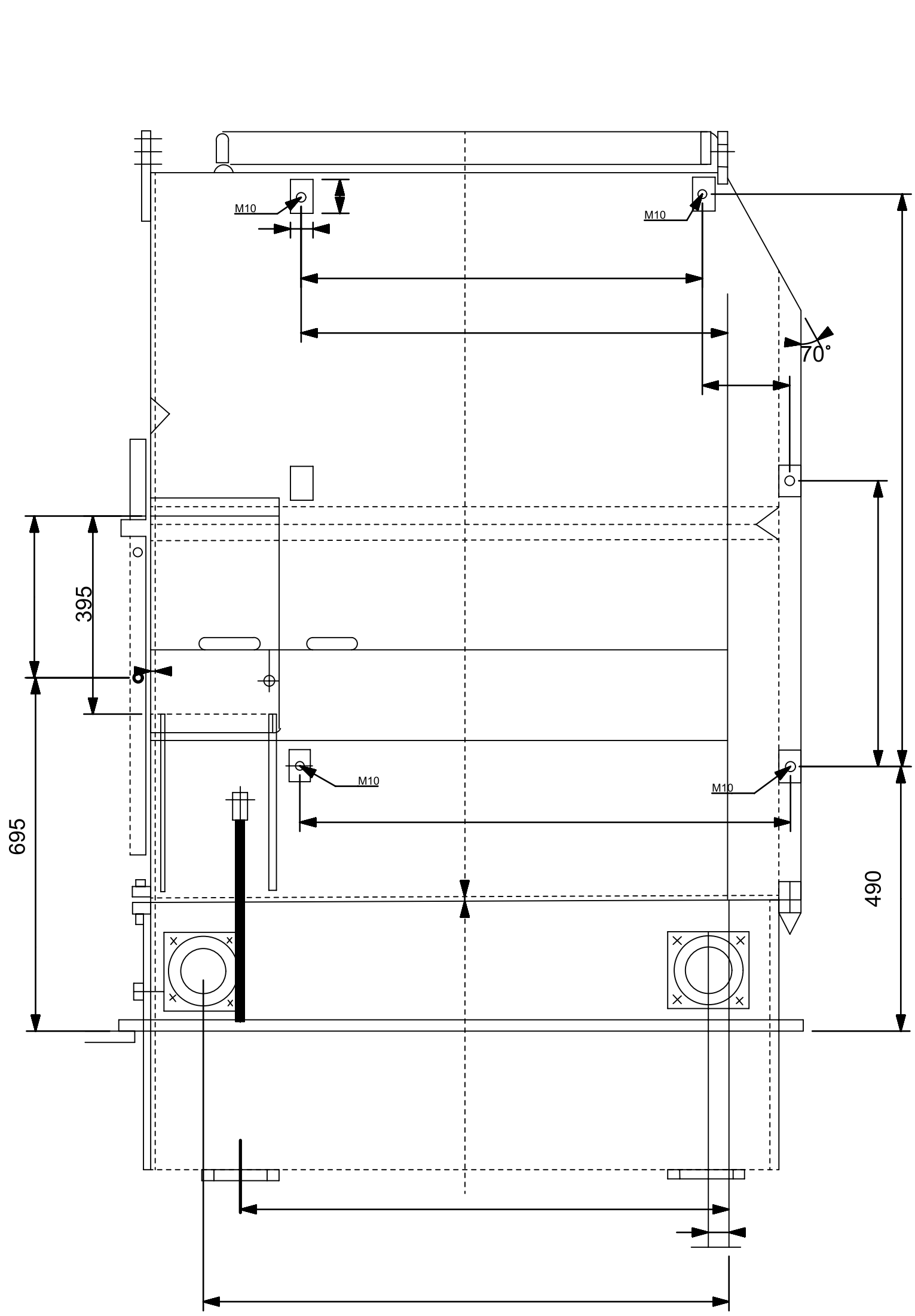
EMPTY WEIGHT-400KG ±5%

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मा. मा. : 813 / अ. मा. सं. : 2553		UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768													
WELDING SYMBOLS TO IS:813 / ISO:2553		पदांक	सं1	सं2	सं3	सं4	सं5	सं6	सं7	सं8	सं9	सं10	सं11	सं12	
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		Rz	0.16-6.3	6.5-12.5	12.5-20	20-31.5	31.5-50	50-63	63-80	80-100	100-125	125-160	160-200	200-250	
		Ra	μm	0.075	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
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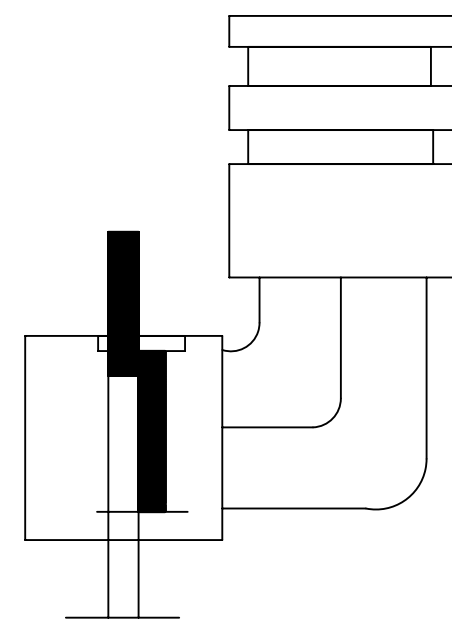
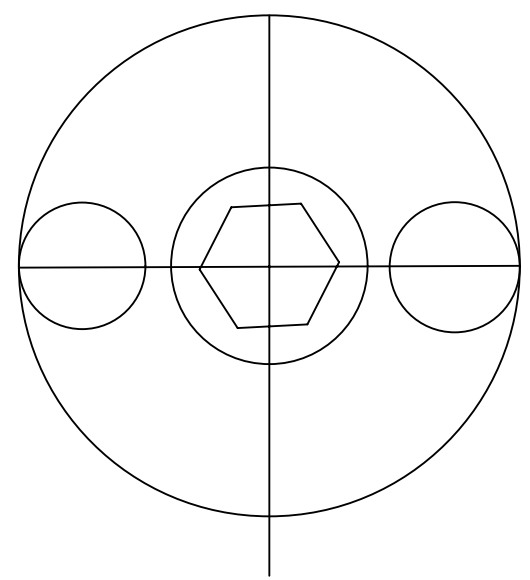
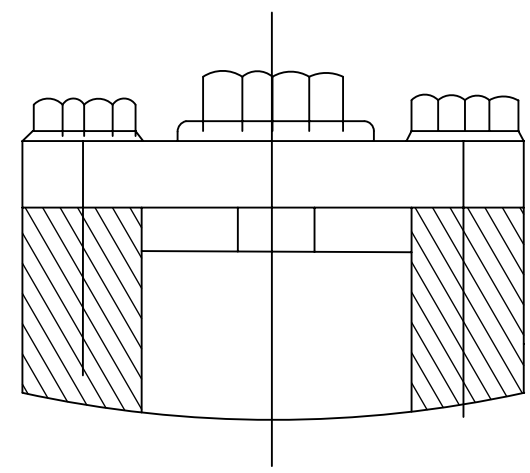
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अधिकृतित DGN	जीवा व.अ.अ. CHD SSE	ANIRB ANIRB BASU	पदार्थ MAIL	प्रति भार कि. घा. WT. EACH IN KG
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	अनुमोदित व.वि.अ. APPROVED DYCEE	Rakesh Rawal	विवरण SPECN	CLWES/3/0102 , ALT 'E'
दिनांक DATE	दिनांक SCALE	1:1	विवरण DESCRIPTION	RADIATOR(OIL COOLER)(For Transformer&Converter)
दिनांक DATED	दिनांक INITIAL		विवरण DRAWING NO.	CLWES/3/SK-1/0102, ALT "E"
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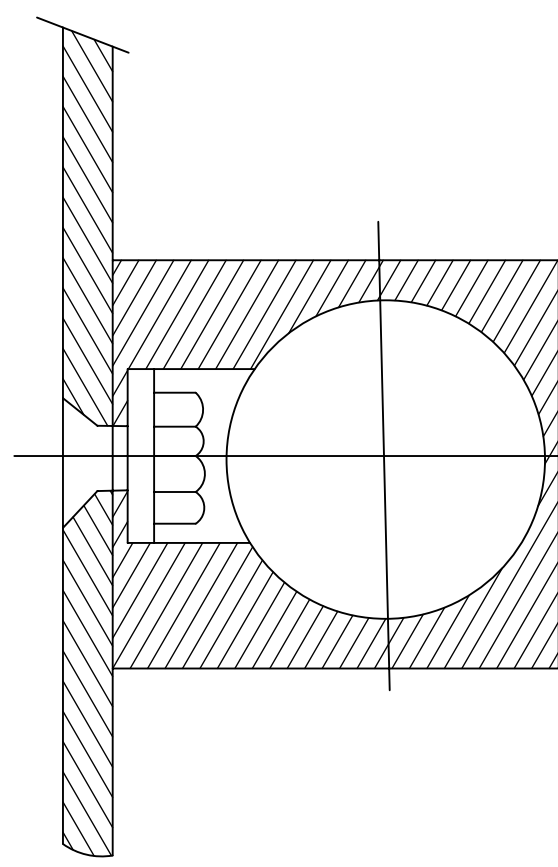
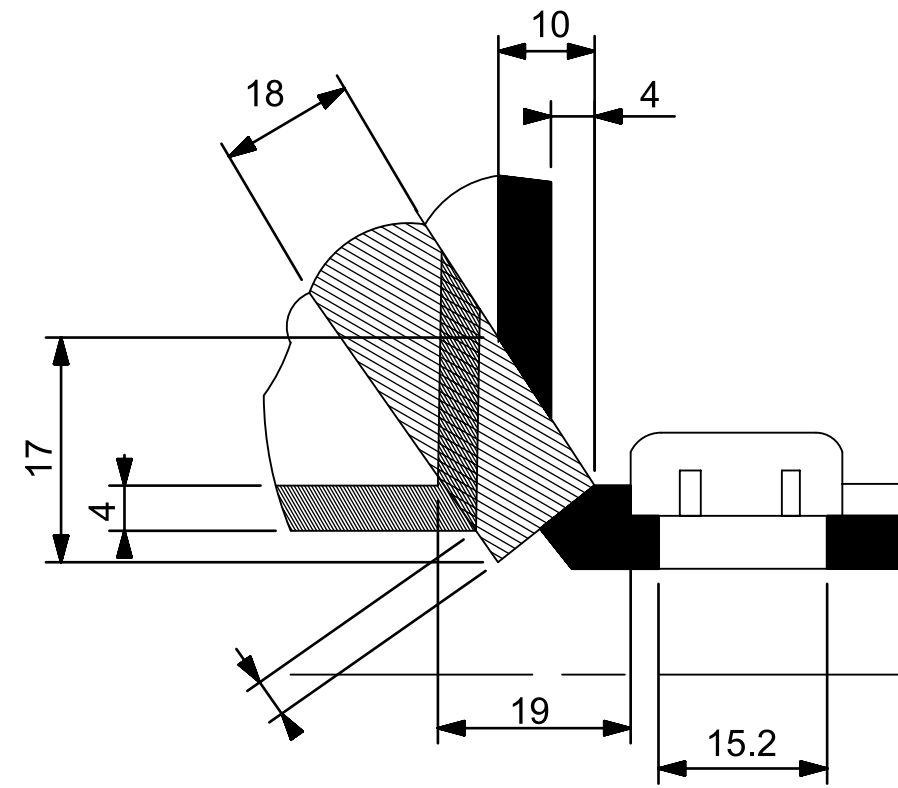
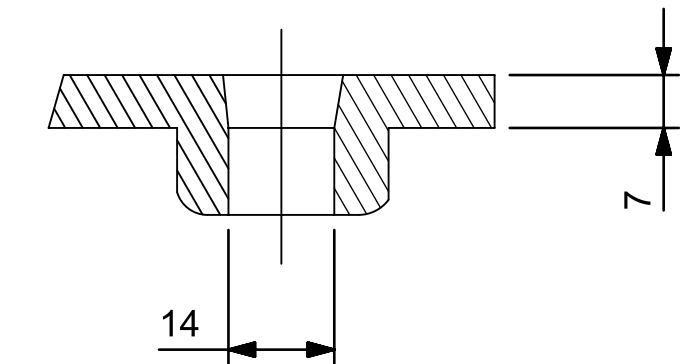
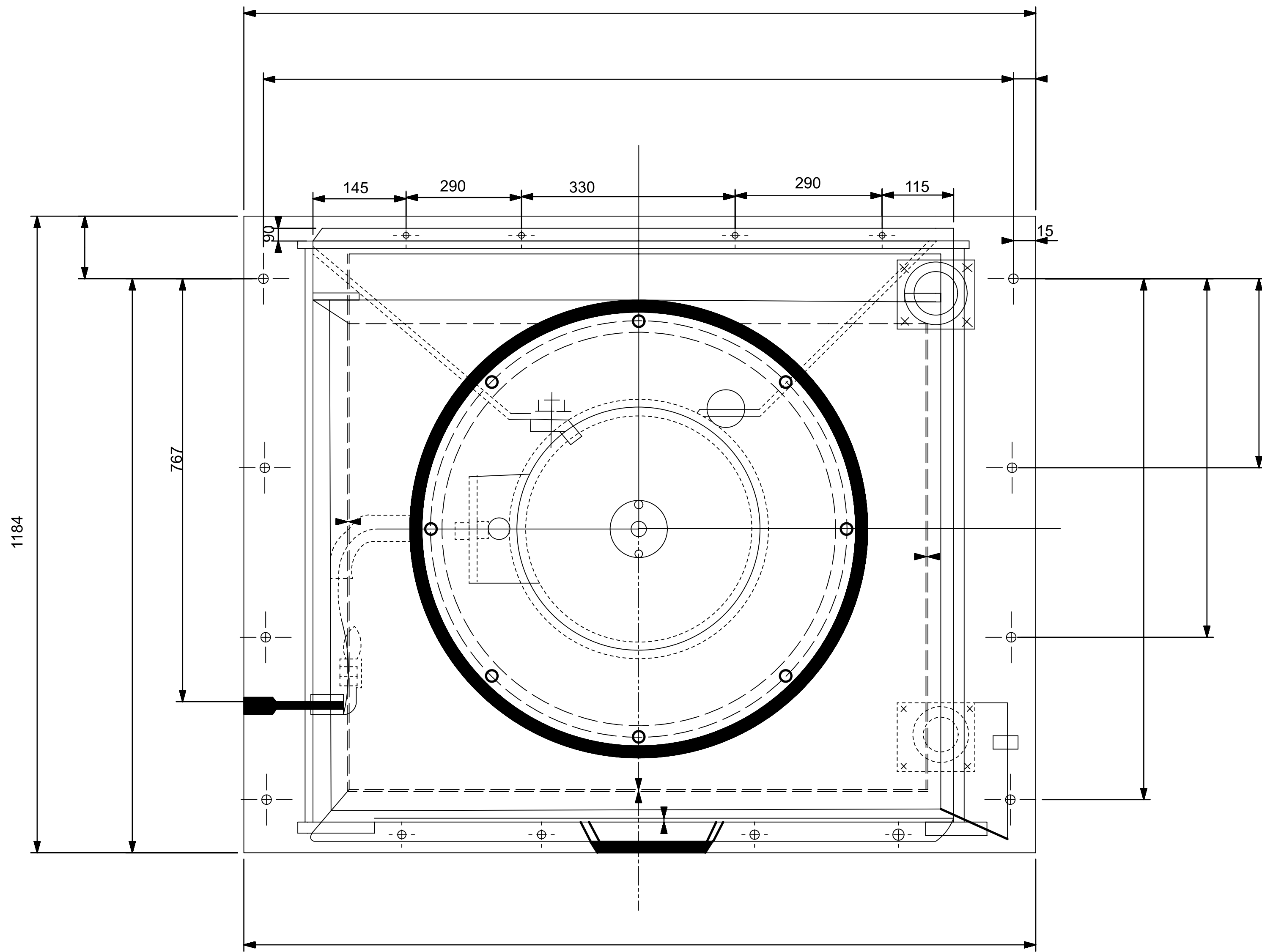
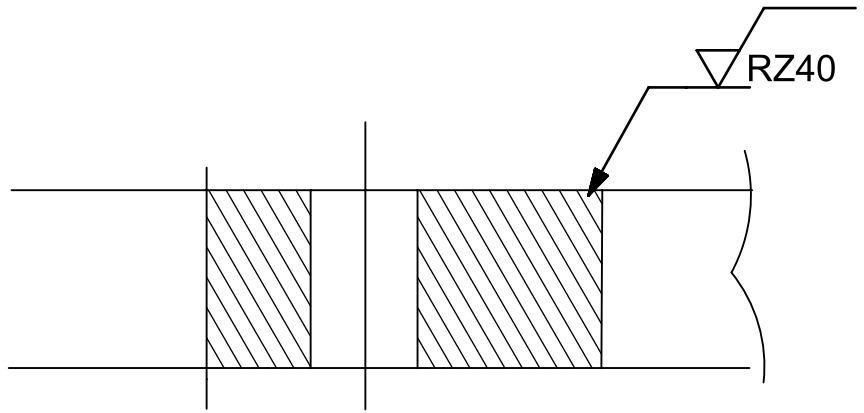
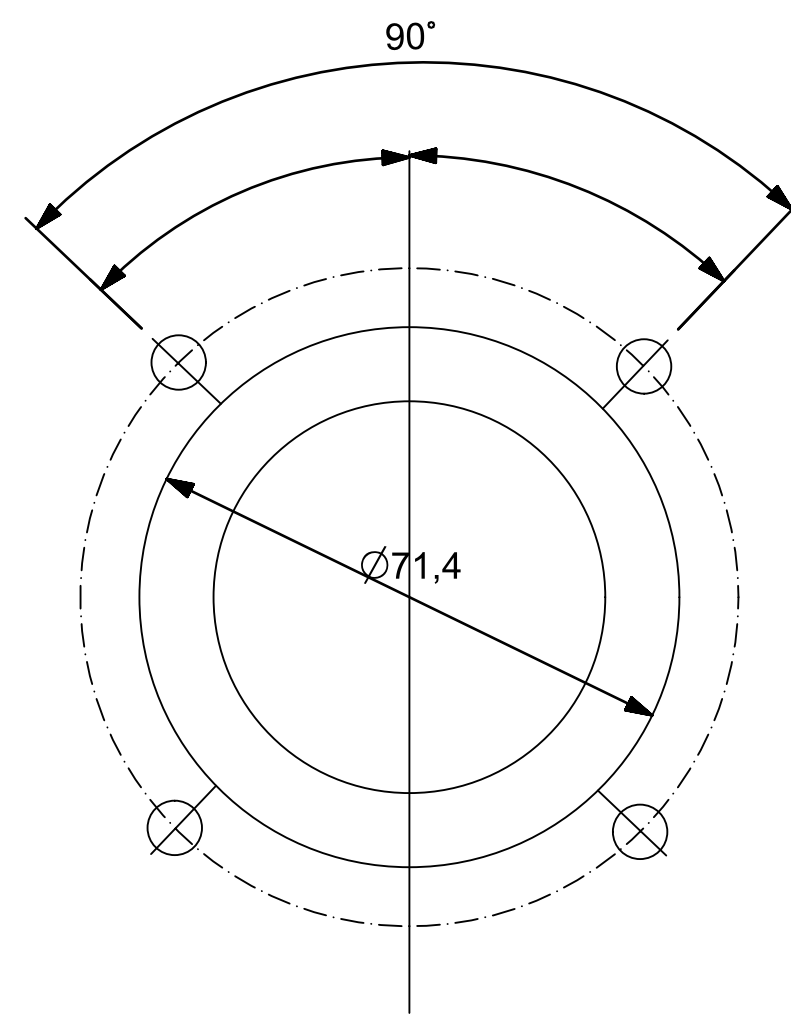
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Detail Y M1:2



VIEW X M1:2



- NOTE:-
1. FOR OTHER DETAILS OF OIL COOLING UNIT REFER TECH SPECN. NO. :-CLW.ES/3/0023
  2. FOR RADIATOR ASSLY. REFER TECH. SPECN. NO.:- CLW/ES/3/0102
  - 3.THIS DRG. IS MEANT FOR TESTING OF OIL COOLER RADIATOR FOR CONVERTER/TRANSFORMER.
  4. THIS UNIT IS NOT IN THE SCOPE OF SUPPLY.

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