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 By	Checked By	Approved By
SSE-Design	SEE -Design	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 sheet No. 6 & 7 have been replaced by new drawing with more details on sheet No. 7	Sd/-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03	30-05-2001	12	C	Drawing Sheet No-12 has been replaced by new drawing sheet No-12 with modification of converter radiator side wall on left side flange has been partly cut (150mm x 33mm) vide modification release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/-
06				Location of Vent Plug depicted in SK-1.	

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

Prepared By	Checked By	Approved By
SSE-Design	SEE -Design	Dy.CEE/D-II

INDEX

1.0 General Description

SPECIFICATION FOR OIL COOLER RADIATOR FOR CONVERTER /TRANSFORMER.

2.0 SCOPE:

This specificaton 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 : As per relevant IS/IEC.

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.

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.)

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 ± 5%

(**D) <u>Tech. Data for Fan</u>:**

Cooling air mass flow	8.8 Kg/Sec
Mass flow density	1.076 Kg/m3
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) <u>Colour</u> - Stone Grey

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

8.0 <u>Test Programs</u>

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
6.	**Weightment test** Weight of the complete Radiator without coolant shall be 400 Kg ± 5%.	Y	Y

7.	**Shock and Vibration Test.** 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 DOCUMENTS TO BE SUPPLIED BY THE TENDERER:

The tenderer shall interalia furnish the following along with the quotation.

a. Clause wise comments on the specification and test programme.
b. Detailed drawings.
c. Past experience with supporting papers (if any).
d. Past test reports (if any).

12.0 TECHNICAL DOCUMENTS TO BE SUPPLIED BY THE SUPPLIER:

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

i) Type test reports.
ii) Routine test reports along with each set
iii) Maintenance manual - One per Unit
iv) Detailed drawings

13.0 Label & Marking:

a) Make
b) Year and Month of Mfg.
c) Sl. No.
d) Trade Mark if any.
e) Drg. No.
f) Order No.

14.0 Hardware:

a) Standard Hardware and Fasteners should be of CLW/BLW/RDSO approved source only to be used.

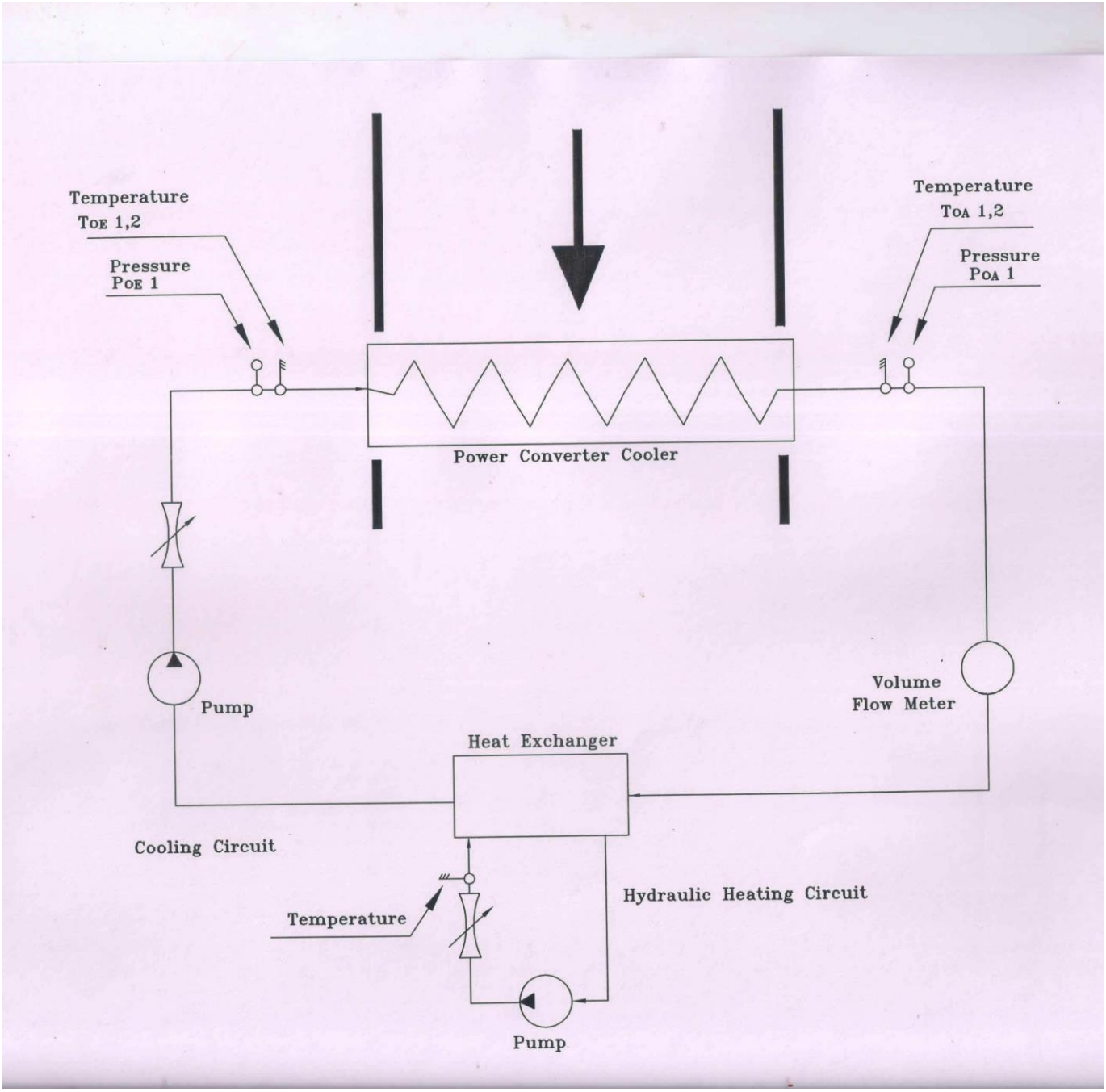
b) Firm should supply 16 nos/ Loco Wire Base Threaded Nut and Bolt as per drawing no-CLW/ES/3/SK-3/102/E.

15.0 <u>Warranty /Guarantee</u>: The supplier must give a clear guarantee of **60** Month from the date of supply or **54** Months from the date of commissioning which ever 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.

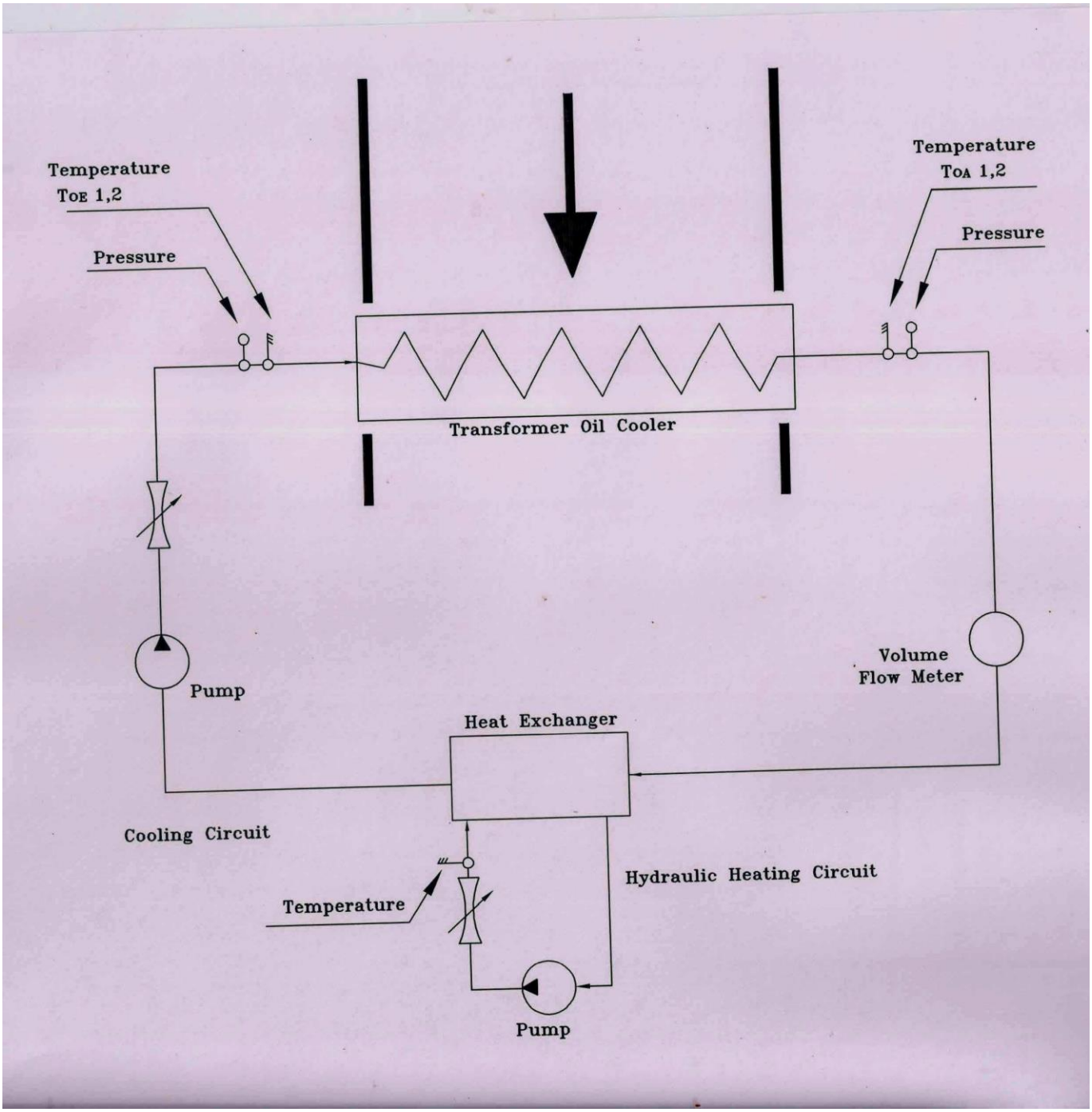
16.0 CHARACTERISTICS OF OIL (SHELL DIALA DX)

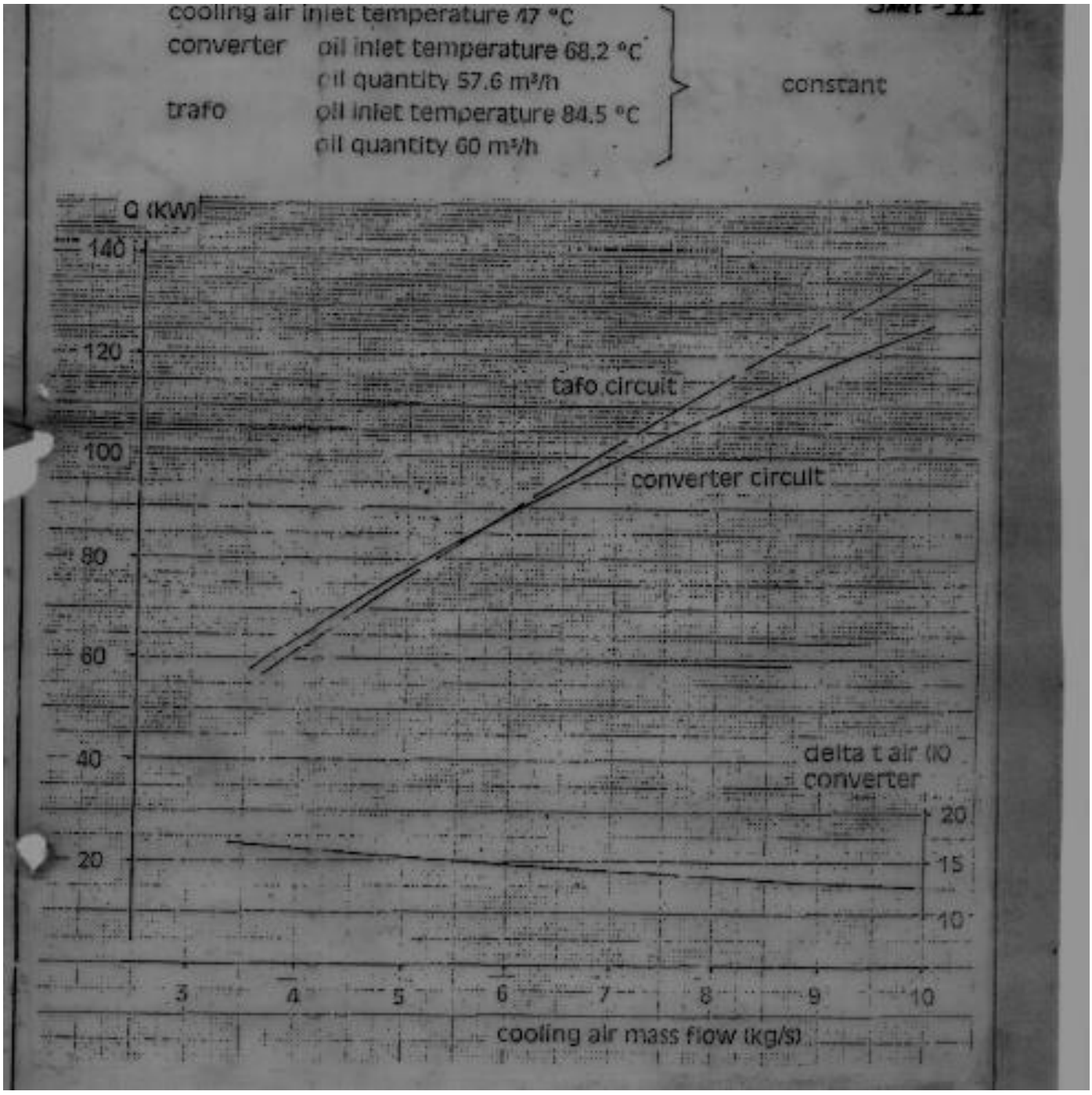
SL. NO.	PARAMETER	UNIT	ACCORDING TO IEC 60296 CLASS II
1.	Appearance		Clear, free from suspended and collected impurities.
2.	Density at 20°C	gm/cm^3	Max. 0.895
3.	Flash point	°C	Min 130
4.	Pour point	°C	Max. - 45
5.	Kinematic viscosity at 40°C	mm^2/s	Max. 11.0
6.	Kinematic viscosity at -30°C	mm^2/s	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

Measuring Point in Circuit 1 (Power Converter)



Measuring Point in Circuit 2 (Transformer)





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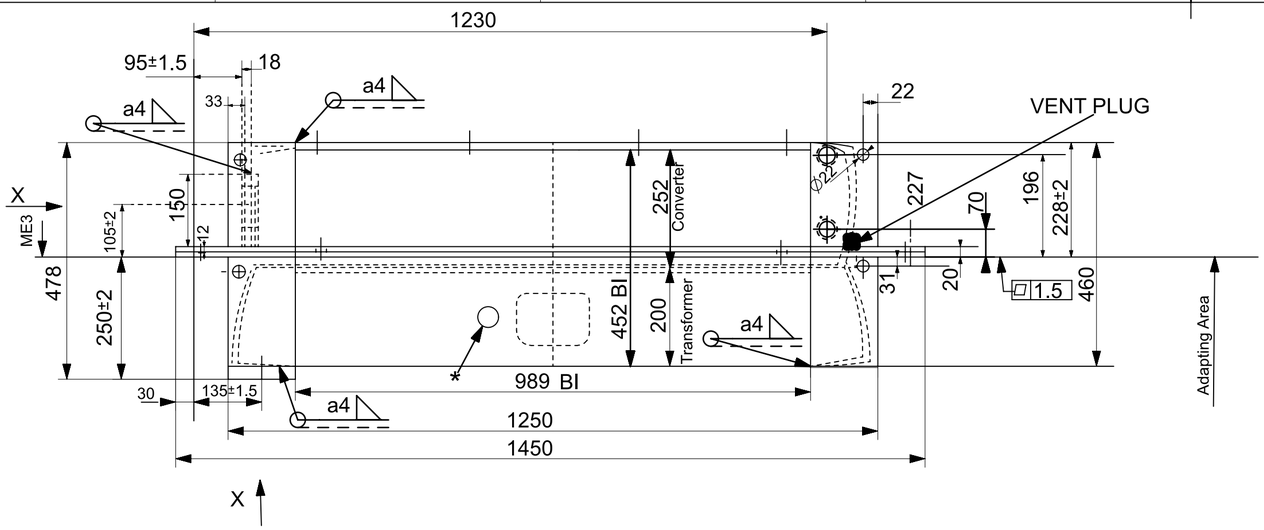
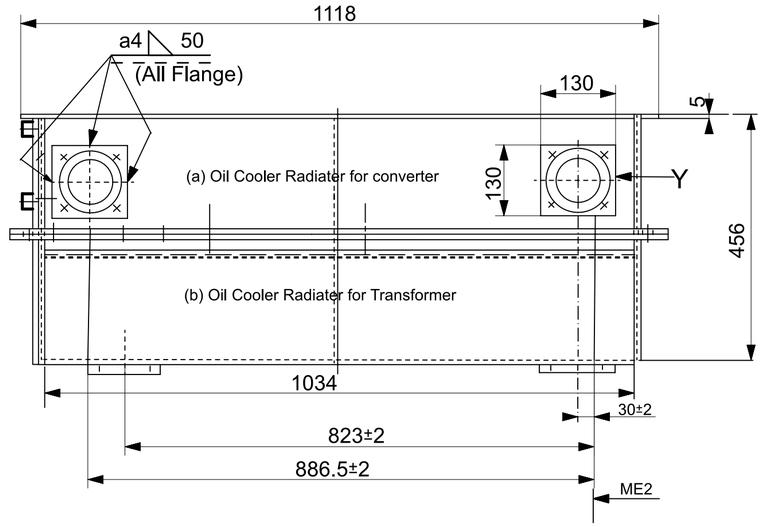
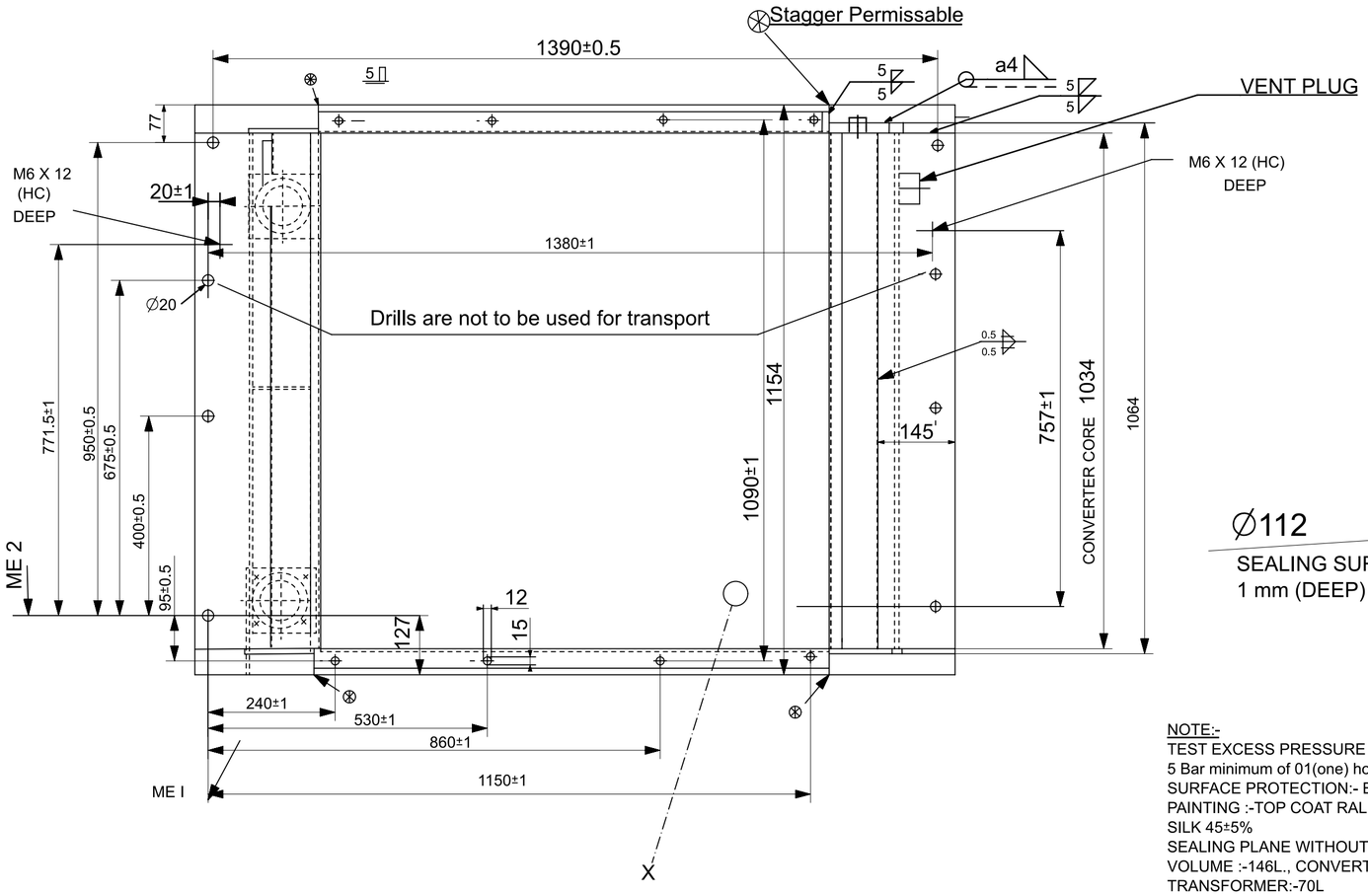
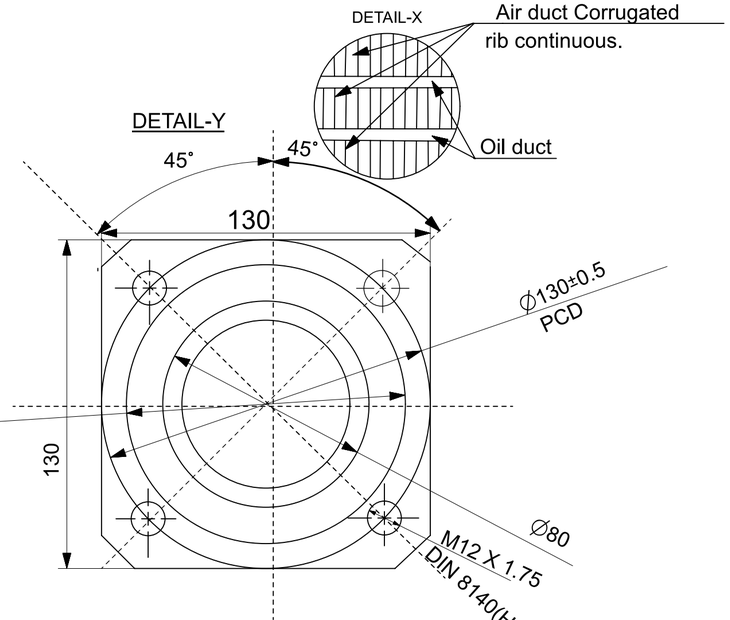
SSE-Design	SEE -Design	Dy.CEE/D-II









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%

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768										TOL. CLS.	
सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
	Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
	Ra µm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
	चिन्ह SYMBOL												

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आदेशर DATED INITIAL

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / ध.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रेखिक अनुपात SCALE	1:1
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्ट SPECN	CLW/ES/3/0102 , ALT 'E'
वर्णन DESCRIPTION	RADIATOR(OIL COOLER)(For Transformer&Converter)
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-1/0102, ALT ''E''
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 12 OF 14 — A2

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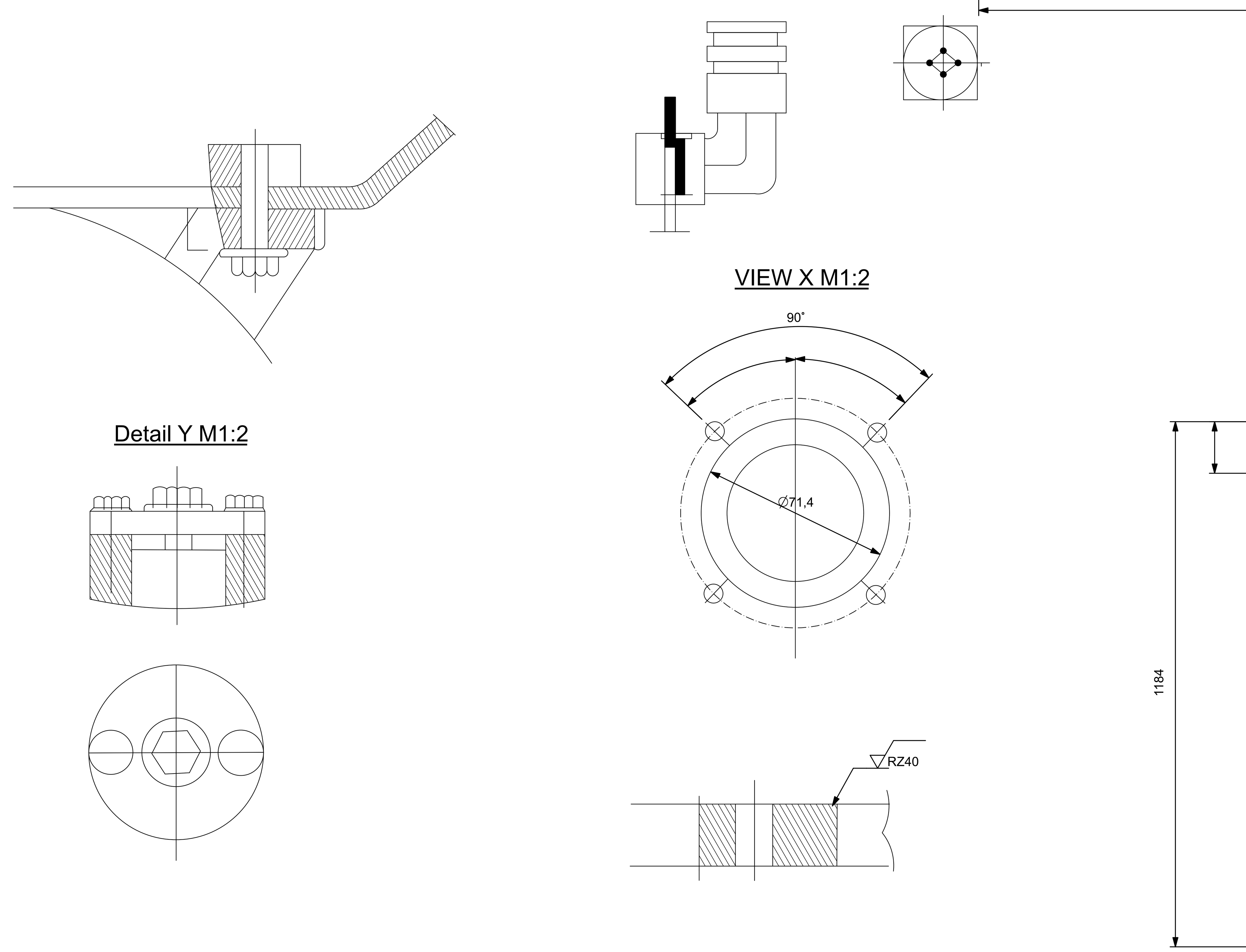

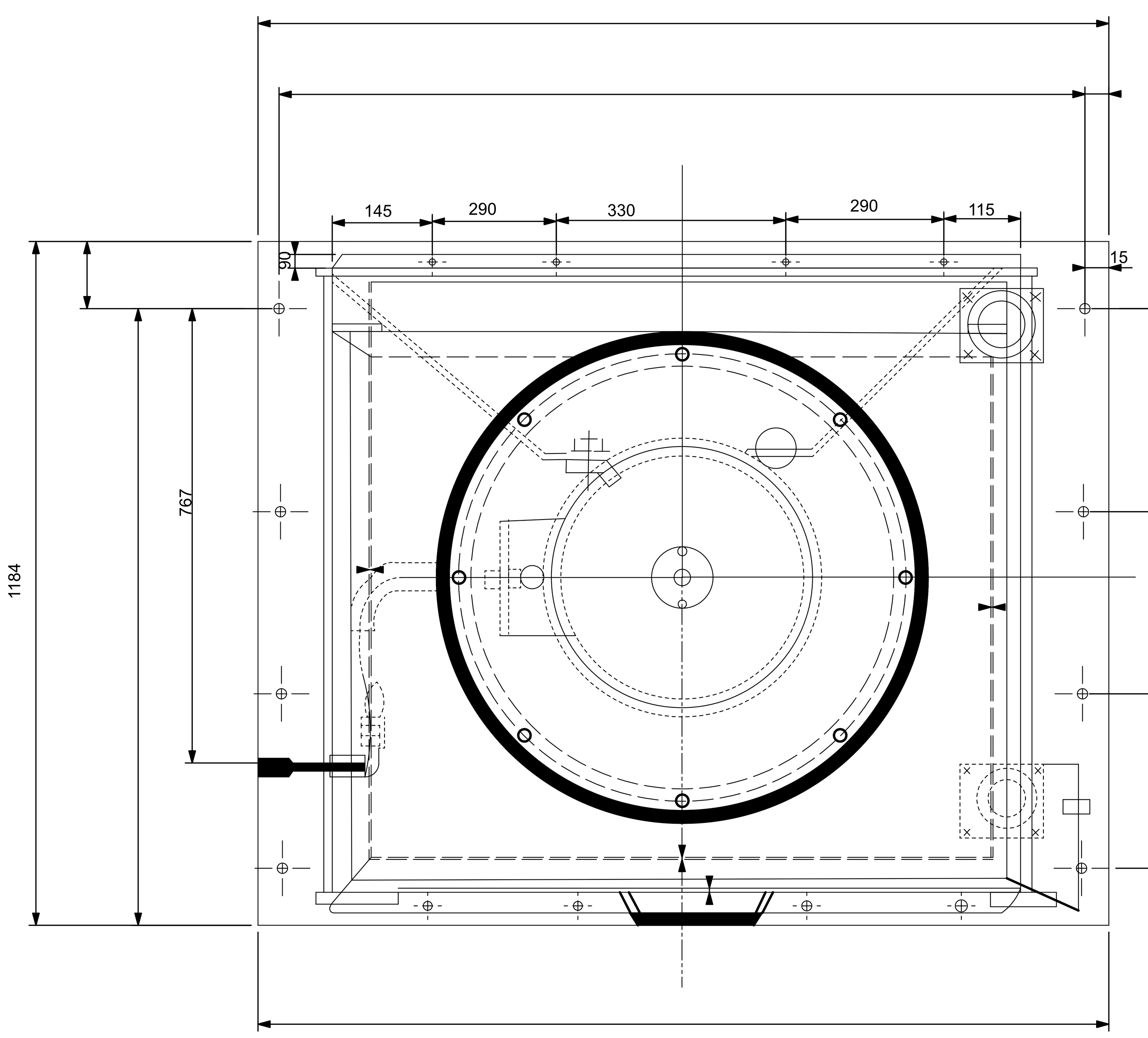

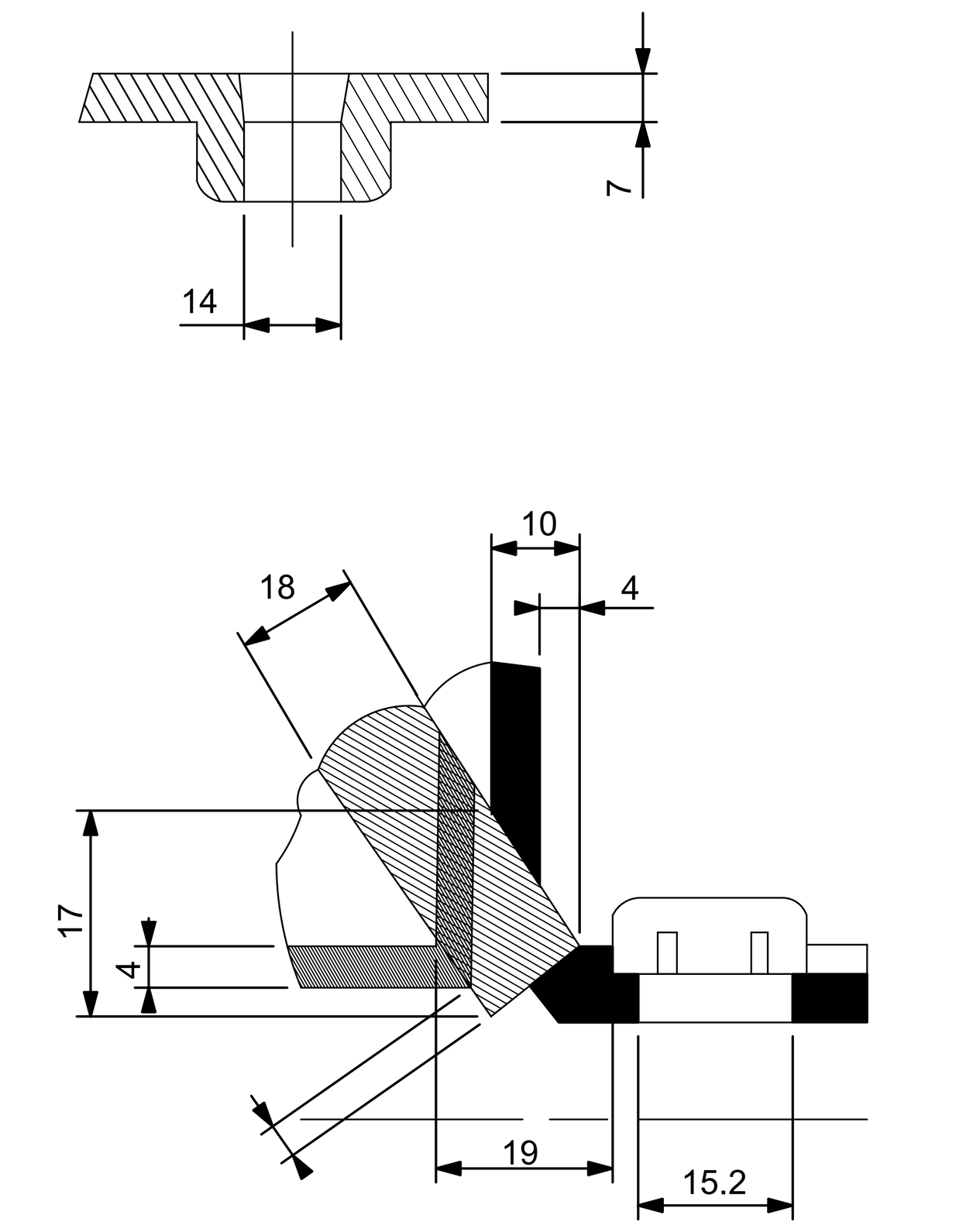

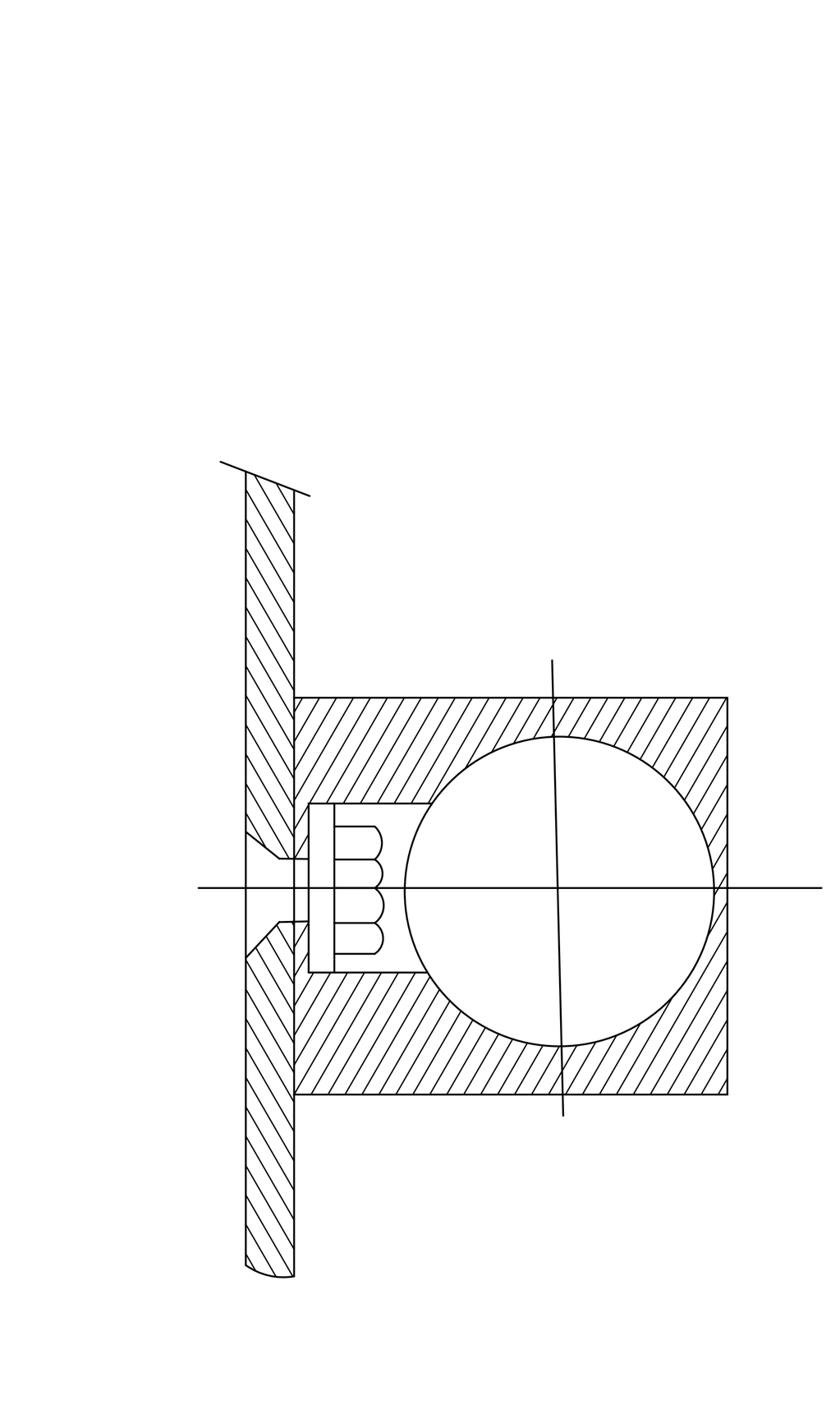

NOTE:-

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.

धातु–वेल्डन चिन्ह
भा. मा. : 813 / अ. मा. सं. :2553
WELDING SYMBOLS TO IS:813 / ISO:2553

सतह – रुक्षता का मान
भा. मा. 3073 / अ. मा. सं. 1302
SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768
UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768
TOL. CLS.

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra µm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL	▽▽▽▽		▽▽▽			▽▽			▽		∼	

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्यक्षर DATED INITIAL

अभिकल्पित DGN	
जॉचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	1:1
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	COMBINED UNIT OF OIL COOLING UNIT & RADIATORS FOR CONVERTER & TRANSFORMER
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0102
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 1 OF 1 — A0

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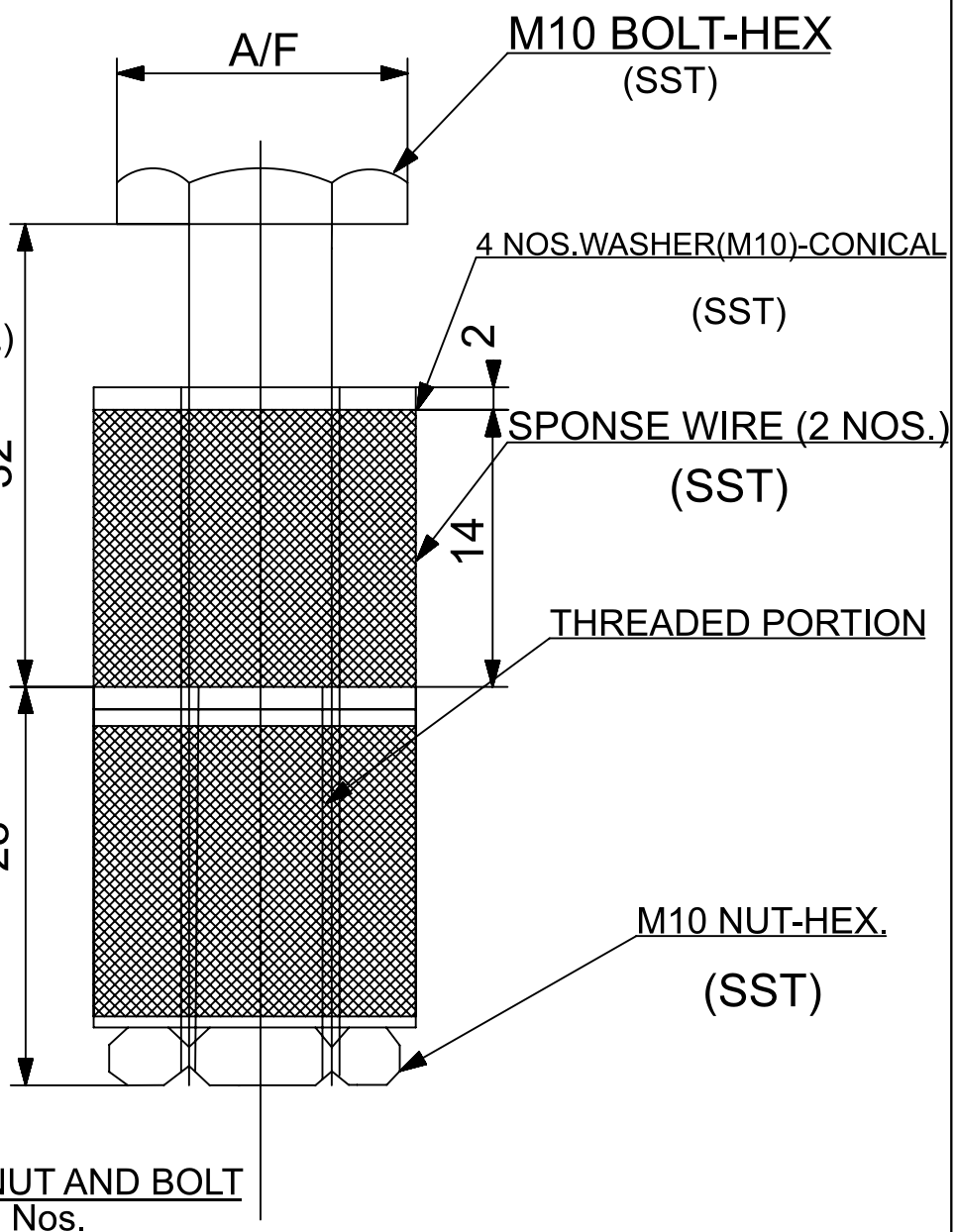

SPONGE WIRE:
INNER DIA: 12
OUTER DIA: 22
THICKNESS : 5 MM(WALL)

WASHER:
INNER DIA: 10.5
OUTER DIA: 22
THICKNESS: 2

LENGTH OF
THREADED PORTION: 28

FREE LENGTH OF
SPONGE WIRE: 14

WIRE BASE THREADED NUT AND BOLT
QUANTITY PER LOCO: 16 Nos.

MATERIAL GRADE: SST DIN 934

ALL DIMENSION ARE IN MM

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्याक्षर DATED INITIAL

सतह – खराश का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768

धातु-वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553

TOL. CLS.

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

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जाँचा व.अ.अ. CHD SSE	
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अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	1:1
संदर्भ / REF. ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

वर्णन DESCRIPTION: RADIATOR (OIL COOLER) FOR TRANSFORMER & CONVERTOR

आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-3/0102

परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 14 OF 14 | A4

REDRAWN BY COE