TECHNICAL NOTE

TITLE: HEATERS, THERMOSTATS & THERMISTORS DESCRIPTION AND LAYOUT

DRL Item or D.R.D. No:

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DATA MANAGEMENT:

DOCUMENT CHANGE RECORD

ISSUE	DATE	REASONS FOR CHANGE	AFFECTED PARAGRAPH
01	10/MAY/99	NEW ISSUE	ALL
02	15/SEP/99	DESIGN IMPROVEMENT	2., 3., 4., 5., 6.1, 6.2, 7., 8.0, 8.1, 10., 11.
03	25/FEB/00	CDR COMMENTS IMPLEMENTATION RID SL-T-003	3.,3.1, 3.2, 3.2.1, 3.2.2, 3.2.3, 4., 5., 5.3, 5.3.1, 5.3.2, 5.3.3, ANNEX A, B, C, D, E, F
04	29/JUN/00	DESIGN IMPROVEMENT	2., 3., 4., 5., 6., 7., 8., 9. ANNEX A, B, F
05	15/DEC/00	CCB 179	4 annex A
		DESIGN EVOLUTION	4 5.3.1 table 6.1(b) / 6.1(d) table 6.2(b) / 6.2(d) 8 scheme 8.1 scheme 8.2 ANNEX A ANNEX D OMC ANNEX F SPI
		new ANNEX	ANNEX G (JEM-X)
06	07/SEP/01	-Deleted ANNEX A (alarm and advise level table)	
		-Solar Array thermistors moved	from table 4.2 to 4.5
		- CDMU, S-RTU, P-RTU, Batteries, Thrusters, IREM Internal thermistors/Thermocouples add	tables 4.5
		- STAR Trackers, IMUE thermistors connected to AOCS H/K add	table 4.6
		- thermistor name beginning with T moved from table 4.4 (d) to table 4.3	tables 4.3 & 4.4 (d)
		- thermistors T5029 & T5036 deleted in 4.4 (b)	table 4.4 (b)
		- CCB # 193 implemented (RCS thermostats)	scheme 8.1 & 8.2
		- NCR n.INT-AI-C-0231 implemented (SAS's thermostats layout)	Figures 7.9 & 7.10 (a)
		- OMC pre-amplificator circuits add (heaters plus thermostats)	para 3.2.2, 5.3.2
		- IBIS position and electrical schemes adds	ANNEX E
		- 15 K Fenwall thermistors instead of Yellow Spring one	para 4, annex B
		- IBIS heaters adds in hardware matrix	para 10
		-SPI compensation heaters line and thermostats add (CCB n 197)	para 3.2.3, 5.3.3 & annex F
		- IBIS detector compensation heater lines (CCB n 209) add	para 3.1,3.2.1,5.2,5.3.1, ANNEX E
		- heater resistance tolerance adds	para 5.1
		- thermostat threshold tolerance adds	para 3.1
		- Calibration Unit heater layout adds	ANNEX E

TABLE OF CONTENTS

LIST OF ACRONYMS

asr	as required
HTR	Heater
IBIS	Imager on Board Integral Satellite
LCL	Current Limiter
NCB	Nickel- Cadmium Battery
P/L	Payload
PLM	Payload Module
PDU	Power Distribution Unit
S/C	Spacecraft
S/L	Satellite
SVM	Service Model
T.	Temperature
TCS	Thermal Control Subsystem
TH	Thermistor
TM_PREF	Telemetry Parameter Reference
TMM	Thermal Mathematical Model
TRP	Temperature Reference Point
TS	Thermostat
TSW	Transistor Switch

1. INTRODUCTION

This document contains a description of heaters, thermistors and thermostats used for the PFM INTEGRAL S/C thermal control and gives all the information useful for their installation such as:

- Type
- Quantity
- Location
- Electrical connections
- Installation drawings

The hardware matrices containing all the items to be installed are reported at the end of the document.

Due to the particularities of RCS items, they are described in a dedicated chapter.

2. APPLICABLE AND REFERENCE DOCUMENT

Applicable documents and drawings are the following:

AD 1 "**Preparazione, installazione e test di heaters per controllo termico impiegati in attivita' spaziali**."
SG-PR-AI-121 issue 02 26/NOV/91

AD 2 RCS THERMAL ANALYSES AND DESIGN
INT-TN-AI-201 issue 1 24/05/00

AD 4 **PLM HEATERS LAYOUT** sheet 1 rev./
031N314 sheet 2 rev./

AD 5 **INTEGRAL THERMAL MATEMATICAL DESCRIPTION AND ANALYSIS RESULTS**
INT-TN-AI-0021 issue 05 16/07/99

AD 6 N/A

AD 7 INTEGRAL SPECTROMETER Doc. SPI-DD-9-3517-CNES issue 1

AD 8 DEFINITION DE L'INSTRUMENTATION THERMIQUE DU CRYOSTAT MODELE DE VOL
Doc. SPI-DD-43-3873-CNES issue 3 06/12/2000

AD 9 SPI FM THERMAL INSTRUMENTATION
Doc. SPI-DD-9-3523-CNES issue 1 12/04/2000

AD 10 EXPERIMENT INTERFACE DOCUMENT – PART B
OMC/INT/20000/ICD/001 issue 5.3 November 2001

AD 11 EXPERIMENT INTERFACE DOCUMENT JEM-X/EID-B issue 5.2 17/03/2000

AD 12 MEC. ICD INT-IC-AI-0002 issue 9 31/07/01

AD 13 WHEEL DRIVE ELECTRONICS (WDE) FM TEST PROCEDURE
XM.TP.MMS.003 issue 2 January 98

AD 14 IBIS EXPERIMENT INTERFACE DOCUMENT – PART B issue 6.1 April 2001

3. THERMOSTATS

3.1 TCS

In the following table 3.1 are reported all the different types of thermostats to be installed on INTEGRAL FM model together with their part number, temperature threshold, quantity and supplier.
The thermostats supplied by Elmwood are procured by ALENIA while the ones supplied by Comepa are procured by CASA. The installation of both types is in charge of ALENIA. Temperature threshold tolerance is ± 3° C.

TYPE	PART NUMBER	TEMP. THRESH.		QUANTITY	SUPPLIER	REMARKS
		ON	OFF			
TS-A	370200101BMLM04 (1)70 (2)30 H3	-23	-17	28	Elmwood	P/L UNIT Red. + SPI I/F Red. + STRH Red
TS-B	370200101BMLM04 (0)20 (0)80 H3	-8	-2	24	Elmwood	P/L UNIT Nom. + SPI I/F Nom.
TS-C	370200101BMLM04 030 (0)30 H3	-3	+3	2+2	Elmwood	SAS +/-Y Red., IBIS Det. Unit
TS-D	370200101BMLM04 060 000 H3	0	6	2	Elmwood	SAS +/-Y Nom.
TS-E	370200101BMLM04 230 170 H3	17	23	8	Elmwood	FCV (+Z) Red.
TS-F	370200101BMLM04 310 250 H3	25	31	34	Elmwood	RCS piping Nom. + FCV (+Z) Nom. +IMUH
TS-G	370200101B625 635H	-35	-25	4	Comepa	SAS Red.
TS-H	370200101B620 630H	-30	-20	4	Comepa	SAS Nom.
TS-L	370200101B604 610H	-10	-4	4	Comepa	STRH Nom.
TS-M	370200101B010 000H	0	10	10	Comepa	RWA Red. + IMUE Red.
TS-N	370200101B015 005H	5	15	12	Comepa	RWANom.+IMUENom. +IMUH
TS-P	370200101B017 011H	11	17	8	Comepa	TANK Red.
TS-Q	370200101B026 020H	20	26	32	Comepa	TANK Nom. + RCS pip. Red.
TS-R	370200101BMLM04 000 (1)00 K	-10	0	8	Elmwood	NCB Red.
TS-S	370200101BMLM04 010 (0)50 K	-5	1	8	Elmwood	NCB Nom.
TS-T	370200101BMLM04 420 220 K3	22	42	8	Elmwood	FCV (-Z) Nom.
TS-U	370200101BMLM04 370 170 K3	17	37	8	Elmwood	FCV (-Z) Red.

Table 3.1: TCS THERMOSTATS ON PLM, SVM AND BATTERY SUMMARY TABLE

3.1.1 THERMOSTATS INSTALLATION

The thermostats will be glued using EC2216 or AV138.
In some cases it can present some problems which are:

- on the TANKS the surface is not flat and, only for the two +Z tanks, the aluminised Kapton tape must be locally removed before thermostats installation;
- in zones which will be covered by MLI or CHO-FOIL and near cables it must be absolutely avoided the risk of short circuits of the thermostat connections with the inner aluminium layer of the MLI (for example on the TANKS, on PT-02 and at SPI I/F) and the cables wrapping. So it is necessary to insulate the thermostat by means of Kapton tape or similar.

In these cases it is requested to everybody the maximum of attention.
In order to optimize the thermostat performance it is required in some location to install a defined thermostat.
These defined thermostats with their part and serial number are reported in annex C.

3.2 INSTRUMENTS THERMOSTATS

In the following paragraphs the thermostats procured and installed by the Scientific Instrument Responsibles are described.

3.2.1 IBIS THERMOSTAT

The following thermostat are installed on IBIS (AD 14):

TYPE	PART NUMBER	TEMP. THRESH. ON	OFF	QUANTITY	SUPPLIER	REMARKS See annex E
TS-a	370200102BMLM04 (1)50 (2)10 H3	-21	-15	6	Elmwood	IBIS DETECTOR Nom. (CsI and CdTe)
TS-b	370200101BMLM04 (2)20 (2)80 H3	-28	-22	6	Elmwood	IBIS DETECTOR Red. (CsI and CdTe)
Ts-c	370200101BMLM04 (2)40 (3)00 H3	*-30*	*-24*	2	Elmwood	IBIS CALIB. UNIT Nom.
Ts-d	370200101BMLM04 (2)70 (3)30 H3	*-33*	*-27*	2	Elmwood	IBIS CALIB. UNIT Red.
Ts-kk	370200101BMLM04 030 (0)30 H3	-3	+3	2	Elmwood	IBIS CALIB. UNIT Red.

NOTE: These thermostats are procured by ALENIA but installed by Subcontractor (LABEN)

3.2.2 OMC THERMOSTAT

The following thermostat are installed on OMC (AD 10):

TYPE	PART NUMBER	TEMP. THRESH. ON	OFF	QUANTITY	SUPPLIER	REMARKS
TS-e1	4727210075604	-5	+5	1	Comepa	SEE fig. annex D main
TS-e2	4727210075605	-5	+5	1	Comepa	SEE fig. annex D main
Ts-f1	472721608613	-5	-10	1	Comepa	SEE fig. annex D redundant
Ts-f2	472721610615	-5	-10	1	Comepa	SEE fig. annex D redundant
Ts-ee	4720021620634	-34	-20	2	Comepa	SEE fig. annex D main
Ts-ff	4720021625641	-41	-25	2	Comepa	SEE fig. annex D redundant

3.2.3 SPI THERMOSTAT

The following thermostat are installed on SPI (AD 9):

TYPE	PART NUMBER	TEMP. THRESH. ON	TEMP. THRESH. OFF	QUANTITY	SUPPLIER	LOCATION See annex F
Ts-g	4727421613618	-18	-13	4	Comepa	Cryo (AD8)
Ts-h1	4727421609614	-14	-9	2	Comepa	MASK i/f ring main (AD9)
Ts-i1	4727421616621	-21	-16	2	Comepa	MASK i/f ring redundant (AD9)
Ts-h2	4727421609614	-14	-9	2	Comepa	ACS UCR tube main (AD7)
Ts-i2	4727421616621	-21	-16	2	Comepa	ACS UCR tube redundant(AD9)
Ts-l1	4727421611616	-16	-11	2	Comepa	AFEE1 skin main (AD9)
Ts-m1	4727421626631	-31	-26	2	Comepa	AFEE1 skin redundant (AD9)
Ts-l2	4727421611616	-16	-11	2	Comepa	AFEE2 skin main (AD9)
Ts-m2	4727421626631	-31	-26	2	Comepa	AFEE2 skin redundant (AD9)
Ts-n1	4727421615620	-20	-15	2	Comepa	DFEE skin main (AD9)
Ts-m3	4727421626631	-31	-26	2	Comepa	DFEE skin redundant (AD9)
Ts-o1	4727421618623	-23	-18	2	Comepa	PSD skin main (AD9)
Ts-m4	4727421626631	-31	-26	2	Comepa	PSD skin redundant (AD9)
Ts-pp1	4727421603608	-9.25*	-3.61*	1	Comepa	On compensation heater nominal line
Ts-pp2	4727421003607	-9.25*	1.77*	1	Comepa	On compensation heater nominal line
Ts-pp3	4727421603608	-8.44*	-4.78*	1	Comepa	On compensation heater redundant line
Ts-pp4	4727421003607	-9.63*	2.47*	1	Comepa	On compensation heater redundant line

* OPEN/CLOSE VALUE MEASURED

4. THERMISTORS

Thermistors will be mounted near item controlled by heaters and in some other location that can provide useful information on the status of the S/C and its equipment.
Thermistor types used will be YSI 44908, BetaTHERM or PT500.
In annex B reduced calibration curves for the thermistors are reported.
Different thermistor types have different temperature ranges and overall accuracy, which are summarised in the following table:

TYPE	Supplier	Name (P./N.)	Resis. @ 25.°C	T. range Min / max [°C]	Overall accuracy [°C]
TH-A	YELLOW SPRINGS	YSI 44908	10. KOhms	-35. / +90.	≤ ± 3. For -30. < T. < -5.°C ≤ ± 2. For -5. < T. < +50.°C
TH-B	BETATHERM	G10K4DX	10. KOhms	-35. / +90.	≤ ± 3. For -30. < T. < -5.°C (TBC) ≤ ± 2. For -5. < T. < +50.°C (TBC)
TH-C	BETATHERM	G4.5K7DX	4.5 KOhms	-50. / +50.	
TH-D	BETATHERM	G0.5K1DX	0.5 KOhms	-90. / –10.	
TH-E	(*)	PT 500		-200. / +200.	≤ ± 6. B.O.L. (lower for low T.) ≤ ± 23. E.O.L. (lower for low T.)
TH-F	FENWALL(*)		15 KOhms	-20. / +74.	
TH-G	FENWALL(*)	GB32	2 KOhms	-40. / +125.	
TH-H	(*)	AD590**			
TH-I	VECO (*)	RTH44	4.0 KOhms	-20/50	
TH-L	ROS (*)	118	0.5 KOhms		
TH-M	(*)	(***)	N/A	N/A	

NOTE: (*) Thermistors used only by Subcontractors, not by Alenia.
(**) semiconductor
(***) Thermocouple NiCr/Ni

In tables 4.1 and 4.2 the list of INTEGRAL thermistors installed by Alenia are reported.
In particular:

- table 4.1 contains the TCS thermistors connected to the PLM RTU;
- tables 4.2 contain the TCS thermistors connected to the SVM RTU;

BetaTHERM thermistors are procured by ALENIA while the YSI ones are procured by CASA. The installation of both types is in charge of ALENIA.

And <u>for information only</u>:

- tables 4.3 contain the thermistors installed by Subcontractor connected to the PLM RTU;
- table 4.4(a) contains the thermistors installed by SPI and connected to his DPE
- table 4.4(b) contains the thermistors installed by JEM-X and connected to his DPE
- table 4.4(c) contains the thermistors installed by IBIS and connected to his DPE
- table 4.4(d) contains the thermistors installed by OMC and connected to his DPE
- table 4.5 contains the thermistors installed by Subcontractor connected to the SVM RTU
- table 4.6 contains the thermistors connected to AOCS HOUSE KEEPING (H/K)

TM_PREF	THERMISTOR NAME	DESCRIPTION	TYPE	Location
T5045	TCS_TH_+Y_TRP	IBIS +Y TRP near middle fin	C	Fig. 4.1 (a)
T5052	TCS_TH_–Y_TRP	IBIS -Y TRP near middle fin	C	Fig. 4.1 (a)
T5046	TCS_TH_+Y_RAD_1	On +Y TCA Radiator between the two heaters on one central H.P.	D	Fig. 4.1 (b)
T5078	TCS_TH_+Y_RAD_2	On +Y TCA Rad. Between the heater and the doubler on one central H.P.	D	Fig. 4.1 (b)
T5053	TCS_TH_-Y_RAD_3	On –Y TCA Rad. between the two heaters on one central H.P.	D	Fig. 4.1 (b)
T5079	TCS_TH_-Y_RAD_4	On -Y TCA Rad. between the heater and the doubler on one central H.P.	D	Fig. 4.1 (b)
T5049	TCS_TH_SPI_TRP	Detector Bench : -Z side near SPI	B	Fig. 4.1 (c)
T5061	TCS_TH_SPI_DPE1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5064	TCS_TH_SPI_DPE2	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5066	TCS_TH_JEMX_TRP	On detector Bench between JEM-X 1&2	B	Fig. 4.1 (c)
T5059	TCS_TH_JEM_DPE1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5062	TCS_TH_JEM_DPE2	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5058	TCS_TH_OMC_DPE	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5043	TCS_TH_IBIS_IEB1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5050	TCS_TH_IBIS_IEB2	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5044	TCS_TH_IBIS_PEB1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5051	TCS_TH_IBIS_PEB2	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5060	TCS_TH_IBIS_DPE1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5063	TCS_TH_IBIS_DPE2	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5056	TCS_TH_IBIS_VEB	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5042	TCS_TH_SPI_CDE1	On Enclosure doubler near the unit	B	Fig. 4.1 (c)
T5048	TCS_TH_SPI_CDE2	On CDE upper doubler near the unit foot	B	F. 4.1(c,d)
T5047	TCS_TH_OMC_TRP	On –Y panel near the CAMERA unit feet	C	Fig. 4.1 (e)
T5054	TCS_TH_IBIS_CU	Near Calibration Unit feet	C	Fig. 4.1 (e)
T5080	TCS_TH_OMC_ELEC	On –Y PLM panel, near unit feet	C	Fig. 4.1 (e)
T4046	TCS_TH_PPDU	On –Z side of detector bench near unit feet	B	Fig. 4.1 (f)
T4061	TCS_TH_PRTU	On –Z side of detector bench near unit feet	B	Fig. 4.1 (f)
T56	TCS_TH_SAS_+Z	Under unit, on its support	B	Fig. 4.1 (g)
T5065	TCS_TH_J_MASK_-Y	On –Y/-Z side of JEM-X mask panel	D	Fig. 4.1 (h)
T5057	TCS_TH_J_MASK _+Y	On +Y/-Z side of JEM-X mask panel	C	Fig. 4.1 (h)
T5055	TCS_TH_IBIS_MASK	On IBIS mask edge, –Y side	C	Fig. 4.1 (i)
T1050	TCS_TH_-Z_PANEL	On –Z panel	C	Fig 4.1 (n)
T1049	TCS_TH_IBIS_DET	On detector bench near IBIS detector	C	Fig 4.1 (c)
TOTAL type B (10. KΩ) **: 19**				
TOTAL type C (4.5 KΩ) **:9**				
TOTAL type D (0.5 KΩ) **: 5**				

Table 4.1: TCS THERMISTORS ON PLM-RTU (installed by Alenia)

TM_PREF	THERMISTOR NAME	DESCRIPTION	TYPE	Location
T6072	TCS_TH_TANK 1_TOP	On Tank 1 Top	A	Fig. 4.2 (a)
T6073	TCS_TH_TANK 1_BOT	On Tank 1 Bottom	A	Fig. 4.2 (a)
T6074	TCS_TH_TANK 2_TOP	On Tank 2 Top	A	Fig. 4.2 (a)
T6075	TCS_TH_TANK 2_BOT	On Tank 2 Bottom	A	Fig. 4.2 (a)
T6076	TCS_TH_TANK 3_TOP	On Tank 3 Top	A	Fig. 4.2 (a)
T6077	TCS_TH_TANK 3_BOT	On Tank 3 Bottom	A	Fig. 4.2 (a)
T6071	TCS_TH_TANK 4_TOP	On Tank 4 Top	A	Fig. 4.2 (a)
T6078	TCS_TH_TANK 4_BOT	On Tank 4 Bottom	A	Fig. 4.2 (a)
T6044	TCS_TH_RCS _THR1A	on FCV of Thruster 1 A	A	Fig. 4.2 (b)
T6045	TCS_TH_RCS _THR1B	on FCV of Thruster 1 B	A	Fig. 4.2 (b)
T6046	TCS_TH_RCS _THR2A	on FCV of Thruster 2 A	A	Fig. 4.2 (b)
T6047	TCS_TH_RCS _THR2B	on FCV of Thruster 2 B	A	Fig. 4.2 (b)
T6048	TCS_TH_RCS _THR3A	on FCV of Thruster 3 A	A	Fig. 4.2 (b)
T6049	TCS_TH_RCS _THR3B	on FCV of Thruster 3 B	A	Fig. 4.2 (b)
T6050	TCS_TH_RCS _THR4A	on FCV of Thruster 4 A	A	Fig. 4.2 (b)
T6051	TCS_TH_RCS _THR4B	on FCV of Thruster 4 B	A	Fig. 4.2 (b)
T6035	TCS_TH_RCS _PT01	on PT01 (below tank 3)	A (*)	Fig. 4.2 (c)
T6036	TCS_TH_RCS _PT02	on PT02 (below tank 2)	A (*)	Fig. 4.2 (c)
T6037	TCS_TH_RCS _PT03	on PT03 (below tank 3)	A (*)	Fig. 4.2 (c)
T6053	TCS_TH_RCS _LV01	on LV01 (below tank 2)	A	Fig. 4.2 (d)
T6034	TCS_TH_RCS _LV02	on LV02 (below tank 3)	A	Fig. 4.2 (d)
T6052	TCS_TH_RCS _LF01	on LF01 (below tank 2)	A	Fig. 4.2 (e)
T6054	TCS_TH_RCS _LF02	on LF02 (below tank 3)	A	Fig. 4.2 (e)
T6038	TCS_TH_RCS _1_+Z	on RCS line 1, side +Z	A	Fig. 8.4 (**)
T6043	TCS_TH_RCS _1_+Y	on RCS line 1, side +Y (on thermostats support)	A	Fig. 8.4 (**)
T6032	TCS_TH_RCS _F&D	on RCS Fill & Drain, behind tank 3	A	Fig. 8.5 (**)
T6040	TCS_TH_RCS _2	on RCS line 2 (on thermostats support)	A	Fig. 8.5 (**)
T6033	TCS_TH_RCS _3	on RCS line 3, behind tank 4	A	Fig. 8.6 (**)
T6030	TCS_TH_RCS _4	on RCS line 4, behind tank 1	A	Fig. 8.7 (**)
T6042	TCS_TH_RCS _5_+Y	on RCS line 5, side +Y	A	Fig. 8.8 (**)
T6055	TCS_TH_RCS _5_-Y	on RCS line 5, side -Y	A	Fig. 8.8 (**)
T6039	TCS_TH_RCS _6	on RCS line 6 (on thermostats support)	A	Fig. 8.9 (**)
T6031	TCS_TH_RCS _7	on RCS line 7, behind tank 2	A	Fig. 8.10(**)
T6041	TCS_TH_RCS _8	on RCS line 8, behind tank 3	A	Fig. 8.11(**)
T6001	TCS_TH_BATTERY+Y	on +Z+Y close to +Y edge of battery	A	Fig. 4.2 (f)
T6000	TCS_TH_BATTERY C	on +Z panel centre between the batteries	A	Fig. 4.2 (f)
T6002	TCS_TH_BATTERY-Y	on +Z+Y close to -Y edge of battery	A	Fig. 4.2 (f)
T6003	TCS_TH_CAE/ACC	on +Z+Y panel between CAE and ACC	A	Fig. 4.2 (f)
TOTAL type A (10. KΩ) **: 35 + 3 (*)**				

NOTE: (*) THERMISTOR already installed in BPD
(**) REF. CHAPTER 8 (dedicated to RCS)

Table 4.2 : TCS THERMISTORS ON SVM RTU (installed by Alenia)

TM_PREF	THERMISTOR NAME	DESCRIPTION	TYPE	Location
T6008	TCS_TH _FSSE1/2	on +Z-Y panel FSSE1 & FSSE2	A	Fig. 4.2 (f)
T6024	TCS_TH_MRU-X-Z	on -Y+Z panel close to MRU (corner X-Z)	A	Fig. 4.2 (g)
T6025	TCS_TH_MRU+Z	on -Y+Z panel close to MRU (side +Z)	A	Fig. 4.2 (g)
T6069	TCS_TH_ SVM_PDU	on -Y-Z panel close to PDU	A	Fig. 4.2 (g)
T6058	TCS_TH_SAHD_-Y-Z	close to solar array hold down	A	Fig. 4.2 (g)
T6056	TCS_TH _RW1/4	on –Z-Y between RWL1 and RWL 4	A	Fig. 4.2 (h)
T6057	TCS_TH _RWDE	on -Z +Y close to RWDE	A	Fig. 4.2 (h)
T6006	TCS_TH_CDMU	on –Z-Y close to CDMU	A	Fig. 4.2 (h)
T511	TCS_TH _IREM	on -Z+Y close to IREM	A	Fig. 4.2 (i)
T6079	TCS_TH_TRSP1	on +Y+Z close to TRSP1	A	Fig. 4.2 (l)
T6080	TCS_TH_TRSP2	on +Y+Z close to TRSP2	A	Fig. 4.2 (l)
T6070	TCS_TH_ SVM_RTU	on +Y+Z panel between RTU and PRU	A	Fig. 4.2 (l)
T6011	TCS_TH_IMUH	on doubler between IMUH 1 & 4	A	Fig. 4.2 (l)
T6009	TCS_TH_IMUE 1-2	on +Y-Z panel close to IMUE 1	A	Fig. 4.2 (l)
T6010	TCS_TH_IMUE 3-4	on +Y-Z panel close to IMUE 2	A	Fig. 4.2 (l)
T6067	TCS_TH_STRE1	on +Y-Z panel close to STRE-1 (and STRE-2)	A	Fig. 4.2 (l)
T6068	TCS_TH_STRE2	on +Y-Z panel close to STRE-2 (and FDCE)	A	Fig. 4.2 (l)
T52	TCS_TH_RMU2	on +Y-Z panel close to RMU2	A	Fig. 4.2 (l)
T50	TCS_TH_RMU1	on +Y-Z panel close to RMU1	A	Fig. 4.2 (l)
T6012	TCS_TH_LPLAT1	on lower platform below tank 1	A	Fig. 4.2 (m)
T6029	TCS_TH_LPLAT2	on lower platform below tank 2	A	Fig. 4.2 (m)
T6013	TCS_TH_LPLAT3	on lower platform below tank 3	A	Fig. 4.2 (m)
T6014	TCS_TH_LPLAT4	on lower platform below tank 4	A	Fig. 4.2 (m)
T6084	TCS_TH_UPLAT1	on upper platform above tank 1	A	Fig. 4.2 (n)
T6085	TCS_TH_UPLAT2	on upper platform above tank 2	A	Fig. 4.2 (n)
T6086	TCS_TH_UPLAT3	on upper platform above tank 3	A	Fig. 4.2 (n)
T6087	TCS_TH_UPLAT4	on upper platform above tank 4	A	Fig. 4.2 (n)
T6004	TCS_TH_CC3	on central cone structure opposite to tank 3	A	Fig. 4.2 (o)
T6005	TCS_TH_CC4	on central cone structure opposite to tank 4	A	Fig. 4.2 (o)
T54	TCS_TH_STRH1	On STRH1 support, near unit feet	A	Fig. 4.2 (p)
T55	TCS_TH_STRH2	On STRH2 support, near unit feet	A	Fig. 4.2 (p)
T51	TCS_TH_SAS_+Y	Under unit, on its support	A	Fig. 4.2 (q)
T53	TCS_TH_SAS_-Y	Under unit, on its support	A	Fig. 4.2 (q)
TOTAL type A (10. KΩ) **: 33**				

Table 4.2 : TCS THERMISTORS ON SVM-RTU (installed by Alenia)

FOR INFORMATION ONLY:

Tm para	SPI electrical I/F identification	THERMISTOR NAME	DESCRIPTION	TYPE	UNIT LOCATION	FIGURE
T5001	t-mask-u1	TH_SPI_STRUC1	Thermistor SPI Structure 1 (mask 1)	A	SPICP	Annex F
T5002	t-lsa-u1	TH_SPI_STRUC2	Thermistor SPI Structure 2 (LSA 1)	A	SPICP	Annex F
T5003	t-as-ssap-u	TH_SPI_STRUC3	Thermistor SPI Structure 3 (ACS 1)	A	SPICP	Annex F
T5004	t-as-lcrp-u	TH_SPI_STRUC4	Thermistor SPI Structure 4 (ACS 3)	A	SPICP	Annex F
T5005	t-as-upringp-u	TH_SPI_STRUC5	Thermistor SPI Structure 5 (ACS 5)	A	SPICP	Annex F
T5006	t-ac-compa-u1	TH_SPICMP_SENSM1	Thermistor SPI Compr. Sens. M1	A	SPICP	Annex F
T5007	t-ac-compb-u1	TH_SPICMP_SENSM3	Thermistor SPI Compr. Sens. M3	A	SPICP	Annex F
T5008	t-ac-dispa-u1	TH_SPIDISP_BOXN1	Thermistor SPI Displacer Box N1	A	SPICP	Annex F
T5009	t-ac-radia-u1	TH_SPICMP&RAD_O1	Thermistor SPI Compr.& Rad. O1	A	SPICP	Annex F
T5010	t-af-tmtc-box-u	TH_SPI_AFEE1	Thermistor SPI AFEE1	A	SPICP	Annex F
T5011	t-af-conv-box-u	TH_SPI_AFEE2	Thermistor SPI AFEE2	A	SPICP	Annex F
T5012	t-df-box-u	TH_SPI_DFEE_M&R	Thermistor SPI DFEE M & R	A	SPICP	Annex F
T5013	t-pd-box-u	TH_SPI_PSD	Thermistor SPI PSD	A	SPICP	Annex F
T5019	t-mask-u2	TH_SPI_STRUC6	Thermistor SPI Structure 6 (mask 2)	A	SPICP	Annex F
T5020	t-lsa-u2	TH_SPI_STRUC7	Thermistor SPI Structure 7 (LSA 2)	A	SPICP	Annex F
T5021	t-as-ssam-u	TH_SPI_STRUC8	Thermistor SPI Structure 8 (ACS 2)	A	SPICP	Annex F
T5022	t-as-lcrm-u	TH_SPI_STRUC9	Thermistor SPI Structure 9 (ACS 4)	A	SPICP	Annex F
T5023	t-as-upringm-u	TH_SPI_STRUC10	Thermistor SPI Structure 10 (ACS 6)	A	SPICP	Annex F
T5024	t-ac-compa-u2	TH_SPICMP_SENSM2	Thermistor SPI Compr. Sens. M2	A	SPICP	Annex F
T5025	t-ac-compb-u2	TH_SPICMP_SENSM4	Thermistor SPI Compr. Sens. M4	A	SPICP	Annex F
T5026	t-ac-dispb-u2	TH_SPIDISP_BOXN2	Thermistor SPI Displacer Box N2	A	SPICP	Annex F
T5027	t-ac-radia-u2	TH_SPICMP&RAD_O2	Thermistor SPI Compr.& Rad. O2	A	SPICP	Annex F
T5102	t-pc-hpamo-u1	HT_PIP_AD_SEN_K1	Heat Pipes Adiab. Sensors K1	E	SPICP	Annex F
T5103	t-pc-hpevap-u1	HT_PIP_EV_SEN_K3	Heat Pipes Evapor.Sensor K3	E	SPICP	Annex F
T5104	t-pc-radia-u1	PASS_RAD_SEN_L1	Passive Radiation Sensor L1	E	SPICP	Annex F
T5105	t-cr-coldbox-u1	200K_STAG_SEN_I1	200K Stage Sensor I1	E	SPICP	Annex F
T5106	t-pc-hpncg-u1	HT_PIP_NCG_SE_J1	Heat Pipe NCG Sensors J1	E	SPICP	Annex F
T5107	t-cr-coldplt-u1	COLD_PLA_TNSF_C1	Cold Plate Transfer C1	E	SPICP	Annex F
T5109	t-pc-hpamo-u2	HT_PIP_AD_SEN_K2	Heat Pipes Adiab. Sensors K2	E	SPICP	Annex F
T5110	t-pc-hpevap-u2	HT_PIP_EV_SEN_K4	Heat Pipes Evapor.Sensor K4	E	SPICP	Annex F
T5111	t-pc-radia-u2	PASS_RAD_SEN_L2	Passive Radiation Sensor L2	E	SPICP	Annex F
T5112	t-cr-coldbox-u2	200K_STAG_SEN_I2	200K Stage Sensor I2	E	SPICP	
T5113	t-pc-hpncg-u2	HT_PIP_NCG_SE_J2	Heat Pipe NCG Sensors J2	E	SPICP	Annex F
T5114	t-cr-coldplt-u2	COLD_PLA_TNSF_C2	Cold Plate Transfer C2	E	SPICP	Annex F

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.3 : PLM RTU THERMISTORS LIST.

FOR INFORMATION ONLY:

TM_PREF	THERMISTOR NAME	DESCRIPTION	TYPE	UNIT LOCATION	FIGURE
T4011	PPDU-A_TEMP_MON	PPDU-A Temp. Monitor Therm node 22000	A	PPDU	
T4012	PPDU-B_TEMP_MON	PPDU-B Temp. Monitor	A	PPDU	
T5028	ODPE_TEMP_MON	ODPE Temp. Monitor Therm node 22170	A	ODPE	
T5029	JDPE1_TEMP_MON	JDPE1 Temp. Monitor Therm node 22050	A	JDPE1	
T5030	IDPE1_TEMP_MON	IDPE1 Temp. Monitor Therm node 22140	A	IDPE1	
T5031	SDPE1_TEMP_MON	SDPE1 Temp. Monitor Therm node 22070	A	SDPE1	
T5108	JDFEE1_THERM_A	JDFEE1 Thermistor A	A	JEM-X DFEE 1	ANNEX G
T5033	JDFEE1_THERM_B	JDFEE1 Thermistor B	A	JEM-X DFEE 1	ANNEX G
T5034	JDFEE1_THERM_C	JDFEE1 Thermistor C	A	JEM-X DFEE 1	ANNEX G
T4013	PRTU_TEMP_MON	PRTU Temp. Monitor Therm node 22001	A	PRTU	
T5036	JDPE2_TEMP_MON	JDPE2 Temp. Monitor Therm node 22150	A	JDPE2	
T5037	JDFEE2_THERM_B	JDFEE2 Thermistor B	A	JEM-X DFEE 2	ANNEX G
T5038	JDFEE2_THERM_C	JDFEE2 Thermistor C	A	JEM-X DFEE 2	ANNEX G
T5115	JDFEE2_THERM_A	JDFEE2 Thermistor A	A	JEM-X DFEE 2	ANNEX G
T5040	IDPE2_TEMP_MON	IDPE2 Temp. Monitor Therm node 22120	A	IDPE2	
T5041	SDPE2_TEMP_MON	SDPE2 Temp. Monitor Therm node 22180	A	SDPE2	
T5069	TH_IBISVDM16	Thermistor IBIS VDM16 (RTU 260)	B		Fig. 4.1 (l)
T5070	TH_IBIS_CDM1	Thermistor IBIS CDM1 (RTU 262)	G	IBIS CU	Fig. E1 -3
T5073	TH_IBIS_VDM9	Thermistor IBIS VDM09 (RTU 258)	B		Fig. 4.1 (l)
T5081	TH_IBISVDM12	Thermistor IBIS VDM12 (RTU 282)	B		Fig. 4.1 (l)

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.3 : PLM RTU THERMISTORS LIST.

FOR INFORMATION ONLY:

TM_PREF	THERMISTOR NAME	DESCRIPTION	TYPE	UNIT LOCATION	FIGURE
T5082	TH_IBISVDM13	Thermistor IBIS VDM13 (RTU284)	B		Fig. 4.1 (l)
T5083	TH_IBIS_CDM2	Thermistor IBIS CDM2 (RTU 286)	G	IBIS CU	Fig. E1 -3
T5072	IBIS_MAINFRA_TH1	Thermist Mainframe-TH1(RTU 263)	B		Fig. 4.1 (l)
T5075	IBIS_MAINFRA_TH2	Thermist Mainframe-TH2(RTU 287)	B		Fig. 4.1 (l)
T5014	OMC_E_UNIT_TEMP1	OMC E_UNIT Temp 1	A	OMC EB	
T5015	OMC_E_UNIT_TEMP2	OMC E_UNIT Temp 2	A	OMC EB	
T5016	OMC_LENS_TEMP1	OMC Lens Temp 1 Therm node 12300	A	OMC	
T5017	OMC_LENS_TEMP2	OMC Lens Temp 2 Therm node 12300	A	OMC	
T5100	CCD_TEMP	OMC CCD Temperature	E	OMC	
T5118	TH_CCD_TEMP_2	CCD Temperature 2 Thermistor	E	OMC	
D9214	PRTUA_POWTEMP	PRTU A Power Sup. Temp.	G	PRTU	
D9218	PRTUB_POWTEMP	PRTU B Power Sup. Temp.	G	PRTU	

NOTE: These thermistors are procured and installed by Subcontractors
* : These thermistors not are connected with RTU

Table 4.3 : PLM RTU THERMISTORS LIST.

Tm para	Thermistor NAME	DESCIPTION	Figure
E2	T_AF_TMTC_L	AFEE I/F TM/TC temperature (electronic board)	
E210	T_AF_PA2_L1	PA 2 temperature #1	
E211	T_AF_PA2_L2	PA 2 temperature #2	
E212	T_AF_PA2_L3	PA 2 temperature #3	
E213	T_AF_PA2_L4	PA 2 temperature #4	
E214	T_AF_PA2_L5	PA 2 temperature #5	
E215	T_AF_PA2_L6	PA 2 temperature #6	
E216	T_AF_PA2_L7	PA 2 temperature #7	
E217	T_AF_PA2_L8	PA 2 temperature #8	
E218	T_AF_PA2_L9	PA 2 temperature #9	
E219	T_AF_PA2_L10	PA 2 temperature #10	
E220	T_AF_PA2_L11	PA 2 temperature #11	
E221	T_AF_PA2_L12	PA 2 temperature #12	
E222	T_AF_PA2_L13	PA 2 temperature #13	
E223	T_AF_PA2_L14	PA 2 temperature #14	
E224	T_AF_PA2_L15	PA 2 temperature #15	
E225	T_AF_PA2_L16	PA 2 temperature #16	
E226	T_AF_PA2_L17	PA 2 temperature #17	
E227	T_AF_PA2_L18	PA 2 temperature #18	
E228	T_AF_PA2_L19	PA 2 temperature #19	
E310	T_AF_LVPS_L1	AFEE DC-DC converter #1 temperature	
E311	T_AF_LVPS_L2	AFEE DC-DC converter #2 temperature	
E312	T_AF_LVPS_L3	AFEE DC-DC converter #3 temperature	
E313	T_AF_LVPS_L4	AFEE DC-DC converter #4 temperature	
E314	T_AF_LVPS_L5	AFEE DC-DC converter #5 temperature	
E315	T_AF_LVPS_L6	AFEE DC-DC converter #6 temperature	
E316	T_AF_LVPS_L7	AFEE DC-DC converter #7 temperature	
E317	T_AF_LVPS_L8	AFEE DC-DC converter #8 temperature	
E318	T_AF_LVPS_L9	AFEE DC-DC converter #9 temperature	
E319	T_AF_LVPS_L10	AFEE DC-DC converter #10 temperature	
E320	T_AF_LVPS_L11	AFEE DC-DC converter #11 temperature	
E321	T_AF_LVPS_L12	AFEE DC-DC converter #12 temperature	
E322	T_AF_LVPS_L13	AFEE DC-DC converter #13 temperature	
E323	T_AF_LVPS_L14	AFEE DC-DC converter #14 temperature	
E324	T_AF_LVPS_L15	AFEE DC-DC converter #15 temperature	
E325	T_AF_LVPS_L16	AFEE DC-DC converter #16 temperature	
E326	T_AF_LVPS_L17	AFEE DC-DC converter #17 temperature	
E327	T_AF_LVPS_L18	AFEE DC-DC converter #18 temperature	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (a): SPI DPE THERMISTORS LIST.

Tm para	Thermistor NAME	DESCIPTION	Figure
E328	T_AF_LVPS_L19	AFEE DC-DC converter #19 temperature	
E330	T_AF_ADC_L1	AFEE Analog Digital Converter #1 temperature	
E331	T_AF_ADC_L2	AFEE Analog Digital Converter #2 temperature	
E332	T_AF_ADC_L3	AFEE Analog Digital Converter #3 temperature	
E333	T_AF_ADC_L4	AFEE Analog Digital Converter #4 temperature	
E334	T_AF_ADC_L5	AFEE Analog Digital Converter #5 temperature	
E335	T_AF_ADC_L6	AFEE Analog Digital Converter #6 temperature	
E336	T_AF_ADC_L7	AFEE Analog Digital Converter #7 temperature	
E337	T_AF_ADC_L8	AFEE Analog Digital Converter #8 temperature	
E338	T_AF_ADC_L9	AFEE Analog Digital Converter #9 temperature	
E339	T_AF_ADC_L10	AFEE Analog Digital Converter #10 temperature	
E340	T_AF_ADC_L11	AFEE Analog Digital Converter #11 temperature	
E341	T_AF_ADC_L12	AFEE Analog Digital Converter #12 temperature	
E342	T_AF_ADC_L13	AFEE Analog Digital Converter #13 temperature	
E343	T_AF_ADC_L14	AFEE Analog Digital Converter #14 temperature	
E344	T_AF_ADC_L15	AFEE Analog Digital Converter #15 temperature	
E345	T_AF_ADC_L16	AFEE Analog Digital Converter #16 temperature	
E346	T_AF_ADC_L17	AFEE Analog Digital Converter #17 temperature	
E347	T_AF_ADC_L18	AFEE Analog Digital Converter #18 temperature	
E348	T_AF_ADC_L19	AFEE Analog Digital Converter #19 temperature	
E391	T_CR_COLDPLT_L1	Cold plate operating temp #1 (oper. mode) A1	Annex F
E392	T_CR_COLDPLT_L2	Cold plate operating temp#2 (oper. mode) A2	Annex F
E393	T_CR_COLDPLT_L3	Cold plate operating temp#3 (oper. mode) A3	Annex F
E394	T_CR_COLDPLT_L4	Cold plate operating temp#4 (oper. mode) A4	Annex F
E395	T_CR_BRAIDS_L1	Thermal braids temp#1 (operational mode) B1	Annex F
E396	T_CR_BRAIDS_L2	Thermal braids temp#2(operational mode) B2	Annex F
E397	T_CR_BRAIDS_L3	Thermal braids temp#3 (operational mode) B3	Annex F
E398	T_CR_BRAIDS_L4	Thermal braids temp#4 (operational mode) B4	Annex F
E2101	T_AS_UPR-RG_L0	UCR temperature n.0 acquisition	
E2102	T_AS_UPR-RG_L1	UCR temperature n.1 acquisition	
E2103	T_AS_UPR-RG_L2	UCR temperature n.2 acquisition	
E2104	T_AS_LWR-RG_L3	LCR temperature n.3 acquisition	
E2105	T_AS_LWR-RG_L4	LCR temperature n.4 acquisition	
E2106	T_AS_LWR-RG_L5	LCR temperature n.5 acquisition	
E2107	T_AS_SID-SH_L6	SSA temperature n.6 acquisition	
E2108	T_AS_SID-SH_L7	SSA temperature n.7 acquisition	
E2109	T_AS_SID-SH_L8	SSA temperature n.8 acquisition	
E2110	T_AS_LWR-SH_L9	LVS1 temperature n.9 acquisition	
E2111	T_AS_LWR-SH_L10	LVS1 temperature n.10 acquisition	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (a): SPI DPE THERMISTORS LIST.

Tm para	Thermistor NAME	DESCIPTION	Figure
E2112	T_AS_LWR-SH_L11	LVS2 temperature n.11 acquisition	
E2113	T_AS_VCU_L12	VCU Temperature n.12 acquisition	
E2114	T_AS_PSAC_L0	Plastic scintillator temperatures	
E2115	T_AS_PSAC_L1	Plastic scintillator temperatures	
E2116	T_AS_PSAC_L2	Plastic scintillator temperatures	
E3828	T_PD_DSP-TMP_L	DSP non memory board temperature	
E3829	T_PD_AD-TMP_L	A/D board temperature	
E3830	T_PD_MX2-TMP_L	Analog Mux 2 board temperature	
E3831	T_PD_MX1-TMP_L	Analog Mux 1 board temperature	
E3977	R_SW_AF-LV-TH_L	AFEE LV monitoring threshold	
E3981	T_CR_COLDBOX_R1	200K cold box temperature #1 D1N	Annex F
E3982	T_CR_COLDBOX_R2	200K cold box temperature #2 D2N	Annex F
E3983	T_CR_COLDBOX_R3	200K cold box temperature #3 D3N	Annex F
E3984	T_CR_COLDBOX_R4	200K cold box temperature #4 D4N	Annex F
E3986	T_DF_BOX_R	Box temperature	
E3988	T_PD_BOX_R	Box temperature	
E3991	T_AS_VCU_R	VCU temperature monitoring	
E3992	T_PC_HEAPP_R1	Heat pipe temperature acquisition #1	Annex F
E3993	T_AF_COLDLK_R	cold link tube temperature acquisition	Annex F
E3994	T_AC_REDCOOL_R1	Active cooling radiator temperature acquisition	Annex F
E3995	T_AF_PWS-BOX_R	AFEE power supply box temperature	
E3996	T_PC_HEATPP_R2	heat pipe temperature acquisition #2	Annex F
E3997	T_AC_REDCOOL_R2	Active cooling radiator temperature acquisition	Annex F
E9032	DPE_HOTPOINT_TEM	SPI DPE1 HOT POINT TEMperature	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (a): SPI DPE THERMISTORS LIST.

TM_PARA	Thermistor name	Description	UNIT_name	DRAWING (doc.+page)
K5103	DET_TEMP_1	Detector Temp 1 AD590 Therm	JDPE1-SW	JEM-X/EID-B_5.2 - pg.138
K9032	DPE_HOTPOINT_TEM	JEM-X DPE1 H POINT Temp	JDPE1-SW	
K5104	DET_TEMP_2	Detector Temp 2 AD590 Therm	JDPE1-SW	JEM-X/EID-B_5.2 - pg.138
L9032	DPE_HOTPOINT_TEM	JEM-X DPE2 HOT POINT Temp	JDPE2-SW	
K5113	TEMP_BOX2	Box2 Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5114	TEMP_CPU	CPU Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5115	TEMP_LVPS_BRIDGE	LVPS Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5116	TEMP_DDHK	DDHK Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5117	TEMP_ANODE	Anode Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5118	TEMP_ANALOG_4	Analog_4 Thermistor YSI-44908	JDPE1-SW	JEM-X/EID-B_5.2 - pg.136
K5379	HV_POW_S_TEMP#1	High Volt Power Sup Therm AD590	JEM-X1	
K5380	HV_POW_S_TEMP#2	High Volt Power Sup Therm AD590	JEM-X1	
L5103	DET_TEMP_1	Detector Temp 1 AD590 Therm	JDPE2-SW	JEM-X/EID-B_5.2 - pg.138
L5104	DET_TEMP_2	Detector Temp 2 AD590 Therm	JDPE2-SW	JEM-X/EID-B_5.2 - pg.138
L5113	TEMP_BOX2	Box2 Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5114	TEMP_CPU	CPU Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5115	TEMP_LVPS_BRIDGE	LVPS Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5116	TEMP_DDHK	DDHK Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5117	TEMP_ANODE	Anode Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5118	TEMP_ANALOG_4	Analog_4 Thermistor YSI-44908	JDPE2-SW	JEM-X/EID-B_5.2 - pg.136
L5379	HV_POW_S_TEMP#1	High Volt Power Sup Therm AD590	JEM-X2	
L5380	HV_POW_S_TEMP#2	High Volt Power Sup Therm AD590	JEM-X2	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (b): JEM-X DPE THERMISTORS LIST.

TM_PARA	Thermistor Name	DESCIPTION	Figure
G9032	DPE_HOTPOINT_TEM	IBIS DPE1 HOT POINT TEMperature	
H9032	DPE_HOTPOINT_TEM	IBIS DPE2 HOT POINT TEMperature	
G2009	I0E-TEMP2-MDU0	Temperature #2 of MDU0	
G2010	I0E-TEMP-DBB0	Temperature of DBB0	
G2023	I0E-TEMP2-MDU1	Temperature #2 of MDU1	
G2024	I0E-TEMP-DBB1	Temperaturre of DBB1	
G2037	I0E-TEMP2-MDU2	Temperature #2 of MDU2	
G2038	I0E-TEMP-DBB2	Temperaturre of DBB2	
G2051	I0E-TEMP2-MDU3	Temperature #2 of MDU3	
G2052	I0E-TEMP-DBB3	Temperature of DBB3	
G2065	I0E-TEMP2-MDU4	Temperature #2 of MDU4.	
G2066	I0E-TEMP-DBB4	Temperature of DBB4.	
G2079	I0E-TEMP2-MDU5	Temperature #2 of MDU5	
G2080	I0E-TEMP-DBB5	Temperature of DBB5	
G2093	I0E-TEMP2-MDU6	Temperature #2 of MDU6	
G2094	I0E-TEMP-DBB6	Temperaturre of DBB6	
G2107	I0E-TEMP2-MDU7	Temperature #2 of MDU7	
G2108	I0E-TEMP-DBB7	Temperature of DBB7	
G2322	I0E-TEMP1-MDU0	Temperature #1 of MDU0	
G2323	I0E-TEMP-MCE0	Temperature of MCE0	
G2324	I0E-TEMP1-IEB1	Temperature #1 of IEB1	
G2472	I0E-TEMP1-MDU1	Temperature #1 of MDU1	
G2473	I0E-TEMP-MCE1	Temperature of MCE1	
G2474	I0E-TEMP2-IEB1	Temperature #2 of IEB1	
G2622	I0E-TEMP1-MDU2	Temperature #1 of MDU2	
G2623	I0E-TEMP-MCE2	Temperature of MCE2	
G2624	I0E-TEMP3-IEB1	Temperature #3 of IEB1	
G2772	I0E-TEMP1-MDU3	Temperature #1 of MDU3	
G2773	I0E-TEMP-MCE3	Temperature of MCE3	
G2774	I0E-TEMP-IFDM1	Temperature of IFDM1	
G2922	I0E-TEMP1-MDU4	Temperature #1 of MDU4	
G2923	I0E-TEMP-MCE4	Temperature of MCE4	
G2924	I0E-TEMP1-IEB2	Temperature #1 of IEB2	
G3072	I0E-TEMP1-MDU5	Temperature #1 of MDU5	
G3073	I0E-TEMP-MCE5	Temperature of MCE5	
G3074	I0E-TEMP2-IEB2	Temperature #2 of IEB2	
G3222	I0E-TEMP1-MDU6	Temperature #1 of MDU6	
G3223	I0E-TEMP-MCE6	Temperature of MCE6	
G3224	I0E-TEMP3-IEB2	Temperature #3 of IEB2	
G3372	I0E-TEMP1-MDU7	Temperature #1 of MDU7	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (c): IBIS DPE THERMISTORS LIST.

TM_PARA	Thermistor Name	DESCIPTION	Figure
G3373	I0E-TEMP-MCE7	Temperature of MCE7	
G3374	I0E-TEMP-IFDM2	Temperature of IFDM2	
G5058	P0E-M1TEMP1	PDM1: Crystal plane temperature #1	
G5059	P0E-M1TEMP2	PDM1: Crystal plane temperature #2	
G5060	P0E-M1TEMP3	PDM1: Cristal plane temperature #3	
G5061	P0E-M1TEMP4	PDM1: Cristal plane temperature #4	
G5074	P0E-M2TEMP1	PDM2: Crystal plane temperature #1	
G5075	P0E-M2TEMP2	PDM2: Crystal plane temperature #2	
G5076	P0E-M2TEMP3	PDM2: Cristal plane temperarure #3	
G5077	P0E-M2TEMP4	PDM2: Cristal plane temperarure #4	
G5090	P0E-M3TEMP1	PDM3: Crystal plane temperature #1	
G5091	P0E-M3TEMP2	PDM3: Crystal plane temperature #2	
G5092	P0E-M3TEMP3	PDM3: Cristal plane temperarure #3	
G5093	P0E-M3TEMP4	PDM3: Cristal plane temperarure #4	
G5106	P0E-M4TEMP1	PDM4: Crystal plane temperature #1	
G5107	P0E-M4TEMP2	PDM4: Crystal plane temperature #2	
G5108	P0E-M4TEMP3	PDM4: Cristal plane temperarure #3	
G5109	P0E-M4TEMP4	PDM4: Cristal plane temperarure #4	
G5122	P0E-M5TEMP1	PDM5: Crystal plane temperature #1	
G5123	P0E-M5TEMP2	PDM5: Crystal plane temperature #2	
G5124	P0E-M5TEMP3	PDM5: Cristal plane temperarure #3	
G5125	P0E-M5TEMP4	PDM5: Cristal plane temperarure #4	
G5138	P0E-M6TEMP1	PDM6: Crystal plane temperature #1	
G5139	P0E-M6TEMP2	PDM6: crystals temperature #2.	
G5140	P0E-M6TEMP3	PDM6: Cristal plane temperarure #3	
G5141	P0E-M6TEMP4	PDM6: Cristal plane temperarure #4	
G5154	P0E-M7TEMP1	PDM7: Crystal plane temperature #1	
G5155	P0E-M7TEMP2	PDM7: Crystal plane temperature #2	
G5156	P0E-M7TEMP3	PDM7: Cristal plane temperarure #3	
G5157	P0E-M7TEMP4	PDM7: Cristal plane temperarure #4	
G5170	P0E-M8TEMP1	PDM8: Crystal plane temperature #1	
G5171	P0E-M8TEMP2	PDM8: Crystal plane temperature #2	
G5172	P0E-M8TEMP3	PDM8: Cristal plane temperarure #3	
G5173	P0E-M8TEMP4	PDM8: Cristal plane temperarure #4	
G6011	V1S-CDMTEMP	CDM Temperature	
G6113	V1E-VEB-TEMP	VEB HK temperature	
G6114	V1E-VEBDCTEMP	VEB DC/DC temperature	
G6119	V0E-VDM01HPVS	VDM01 HVPS temperature	
G6120	V0E-VDM01BGO	VDM01 BGO/PMT temperature	
G6121	V0E-VDM01VME	VDM01 VME temperature	
G6126	V0E-VDM02HPVS	VDM02 HVPS temperature	
G6127	V0E-VDM02BGO	VDM02 BGO/PMT temperature	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (c): IBIS DPE THERMISTORS LIST.

TM_PARA	Thermistor Name	DESCIPTION	Figure
G6128	V0E-VDM02VME	VDM02 VME temperature	
G6133	V0E-VDM03HPVS	VDM03 HVPS temperature	
G6134	V0E-VDM03BGO	VDM03 BGO/PMT temperature	
G6135	V0E-VDM03VME	VDM03 VME temperature	
G6140	V0E-VDM04HPVS	VDM04 HVPS temperature	
G6141	V0E-VDM04BGO	VDM04 BGO/PMT temperature	
G6142	V0E-VDM04VME	VDM04 VME temperature	
G6147	V0E-VDM05HPVS	VDM05 HVPS temperature	
G6148	V0E-VDM05BGO	VDM05 BGO/PMT temperature	
G6149	V0E-VDM05VME	VDM05 VME temperature	
G6154	V0E-VDM06HPVS	VDM06 HVPS temperature	
G6155	V0E-VDM06BGO	VDM06 BGO/PMT temperature	
G6156	V0E-VDM06VME	VDM06 VME temperature	
G6161	V0E-VDM07HPVS	VDM07 HVPS temperature	
G6162	V0E-VDM07BGO	VDM07 BGO/PMT temperature	
G6163	V0E-VDM07VME	VDM07 VME temperature	
G6168	V0E-VDM08HPVS	VDM08 HVPS temperature	
G6169	V0E-VDM08BGO	VDM08 BGO/PMT temperature	
G6170	V0E-VDM08VME	VDM08 VME temperature	
G6175	V0E-VDM09HPVS	VDM09 HVPS temperature	
G6176	V0E-VDM09BGO	VDM09 BGO/PMT temperature	
G6177	V0E-VDM09VME	VDM09 VME temperature	
G6182	V0E-VDM10HPVS	VDM10 HVPS temperature	
G6183	V0E-VDM10BGO	VDM10 BGO/PMT temperature	
G6184	V0E-VDM10VME	VDM10 VME temperature	
G6189	V0E-VDM11HPVS	VDM11 HVPS temperature	
G6190	V0E-VDM11BGO	VDM11 BGO/PMT temperature	
G6191	V0E-VDM11VME	VDM11 VME temperature	
G6196	V0E-VDM12HPVS	VDM12 HVPS temperature	
G6197	V0E-VDM12BGO	VDM12 BGO/PMT temperature	
G6198	V0E-VDM12VME	VDM12 VME temperature	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (c): IBIS DPE THERMISTORS LIST.

TM_PARA	Thermistor Name	DESCIPTION	Figure
G6203	V0E-VDM13HPVS	VDM13 HVPS temperature	
G6204	V0E-VDM13BGO	VDM13 BGO/PMT temperature	
G6205	V0E-VDM13VME	VDM13 VME temperature	
G6210	V0E-VDM14HPVS	VDM14 HVPS temperature	
G6211	V0E-VDM14BGO	VDM14 BGO/PMT temperature	
G6212	V0E-VDM14VME	VDM14 VME temperature	
G6217	V0E-VDM15HPVS	VDM15 HVPS temperature	
G6218	V0E-VDM15BGO	VDM15 BGO/PMT temperature	
G6219	V0E-VDM15VME	VDM15 VME temperature	
G6224	V0E-VDM16HPVS	VDM16 HVPS temperature	
G6225	V0E-VDM16BGO	VDM16 BGO/PMT temperature	
G6226	V0E-VDM16VME	VDM16 VME temperature	
G6227	V0E-CDM01BGO	CDM01 BGO/PMT temperature	
G6228	V0E-CDM02BGO	CDM02 BGO/PMT temperature	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (c): IBIS DPE THERMISTORS LIST.

TM_PARA	THERMISTOR NAME	DESCIPTION	UNIT_NAME	DRAWING (doc.+page)
M9032	DPE_HOTPOINT_TEM	OMC DPE HOT POINT TEMP	ODPE-SW	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.4 (d): OMC DPE THERMISTORS LIST.

FOR INFORMATION ONLY:

TM_PREF	THERMISTOR NAME	DESCRIPTION	Type	Unit Location	Figure
T1	TEMP_CTU_A_TCXO	Temperature CDMU CTU A TCXO	A	CDMU	
T2	TEMP_CTU_B_TCXO	Temperature CDMU CTU B TCXO	A	CDMU	
T3	TEMP_CDMU_TREF	Thermistor CDMU TRP	A	CDMU	
T510	TEMP_IREM	IREM Temperature Monitor	A	IREM	
T13	TEMP_MRU_1	MRU Thermistor 1	A	MRU	
T17	TEMP_MRU_2	MRU Thermistor 2	A	MRU	
T7000	TEMP_PRU-A	Thermistor PRU1	A	PRU	
T7001	TEMP_PRU-B	Thermistor PRU2	A	PRU	
T23	TEMP_RMUA	Reserved to RMUA	A	RMU1	
T28	TEMP_RMUB	Reserved to RMUB	A	RMU2	
T27	TEMP_RWA3	Temperature RWA3	F	RWA	
T30	TEMP_RWA4	Temperature RWA4	F	RWA	
T11	TEMP_SPDUA	Temperature SPDU A	A	SPDU	
T12	TEMP_SPDUB	Temperature SPDU B	A	SPDU	
T6	TEMP_SRTU	Thermistor SVM RTU TRP	A	SRTU	
T7	TEMP_TRSP1_RX	Temperature TRSP1 RX	A	TRSP1	
T8	TEMP_TRSP1_TX	Temperature TRSP1 TX	A	TRSP1	
T10	TEMP_TRSP2_TX	Temperature TRSP2 TX	A	TRSP2	
T9	TEMP_TRSP2_RX	Temperature TRSP2 RX	A	TRSP2	
T21	TEMP_WDE1	Temperature WDE1	A	WDE	
T22	TEMP_RWA1	Temperature RWA1	F	RWA	
T24	TEMP_WDE2	Temperature WDE2	A	WDE	
T25	TEMP_RWA2	Temperature RWA2	F	RWA	
T26	TEMP_WDE3	Temperature WDE3	A	WDE	
T29	TEMP_WDE4	Temperature WDE4	A	WDE	
T18	TCS_TH_SA_+Y1	on solar array rear side + y wing 1	A	S.A.	
T19	TCS_TH_SA_+Y2	on solar array rear side + y wing 2	A	S.A.	
T20	TCS_TH_SA_+Y3	on solar array rear side + y wing 3	A	S.A.	
T14	TCS_TH_SA_-Y1	on solar array rear side – y wing 1	A	S.A.	
T15	TCS_TH_SA_-Y2	on solar array rear side – y wing 2	A	S.A.	
T16	TCS_TH_SA_-Y3	on solar array rear side – y wing 3	A	S.A.	

NOTE: These thermistors are procured and installed by Subcontractors

Table 4.5: SVM RTU THERMISTORS LIST

TM_PREF	THERMISTOR NAME	DESCRIPTION	Type	Unit Location	Figure
D9007	CDA_POWTEMP	CDMU A Power Sup. Temp.	G	CDMU	
D9016	CDB_POWTEMP	CDMU B Power Sup. Temp.	G	CDMU	
D9102	SRTUA_POWTEMP	SRTU A Power Sup. Temp.	G	SRTU	
D9106	SRTUB_POWTEMP	SRTU B Power Sup. Temp.	G	SRTU	
P3400	BAT1_TEMP_1	BAT 1 temperature 1	I	Battery 1	
P3401	BAT1_TEMP_2	BAT 1 temperature 2	I	Battery 1	
P3402	BAT1_TEMP_3	BAT 1 temperature 3	I	Battery 1	
P3403	BAT2_TEMP_1	BAT 2 temperature 1	I	Battery 2	
P3404	BAT2_TEMP_2	BAT 2 temperature 2	I	Battery 2	
P3405	BAT2_TEMP_3	BAT 2 temperature 3	I	Battery 2	
T100	TCP-1A	TCP 1A (Thruster)	M	Thruster	
T101	TCP-2A	TCP 2A (Thruster)	M	Thruster	
T102	TCP-3A	TCP 3A (Thruster)	M	Thruster	
T103	TCP-4A	TCP 4A (Thruster)	M	Thruster	
T104	TCP-1B	TCP 1B (Thruster)	M	Thruster	
T105	TCP-2B	TCP 2B (Thruster)	M	Thruster	
T106	TCP-3B	TCP 3B (Thruster)	M	Thruster	
T107	TCP-4B	TCP 4B (Thruster)	M	Thruster	
U9941	T_7_PROCESSED	Integral Operation Mode: Internal Temperature	A	IREM	
U9942	T_8_PROCESSED	Integral Operation Mode: Temperature of D1/D	A	IREM	
U9943	T_9_PROCESSED	Integral Operation Mode: Temperature of D3	A	IREM	

NOTE: These thermistors are procured and installed by Subcontractors

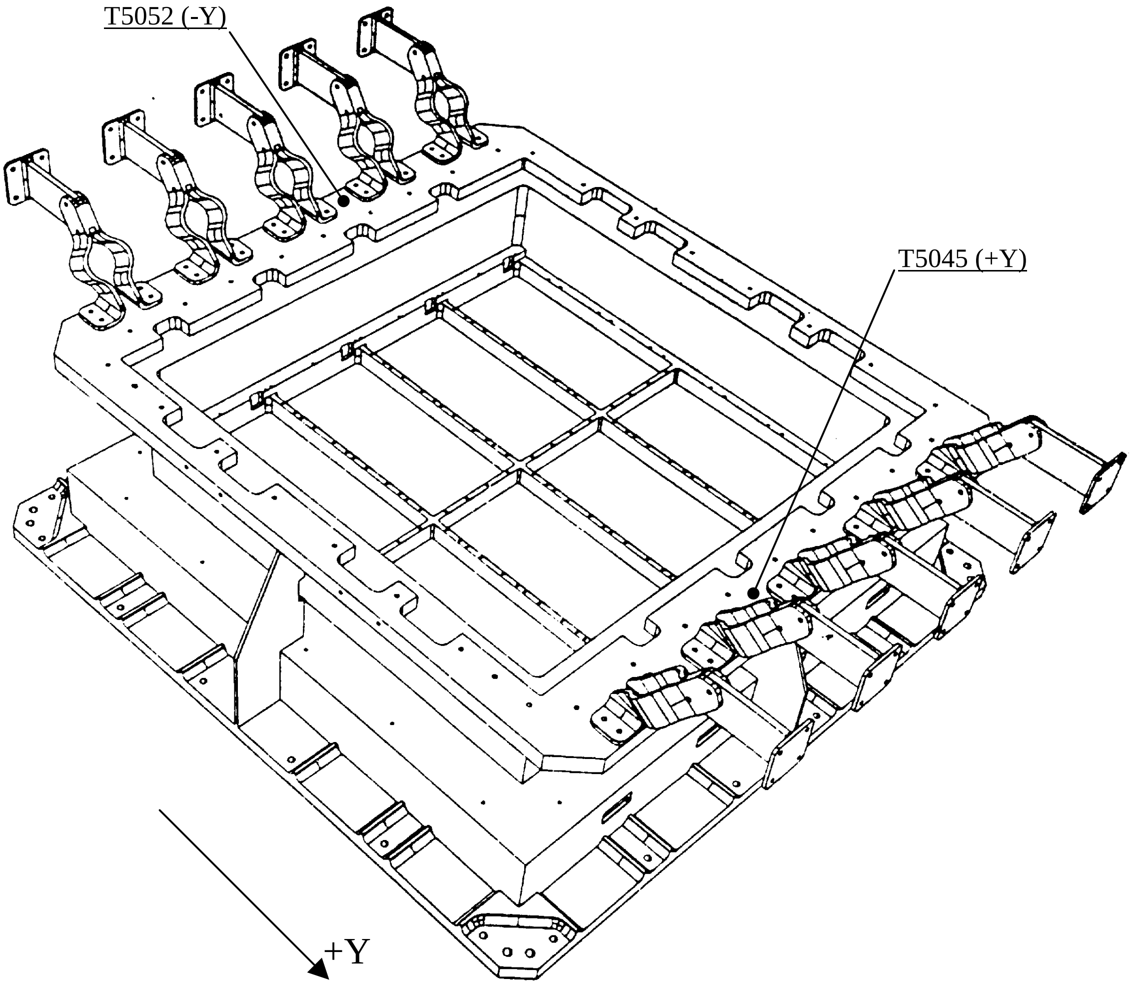
Table 4.5: SVM RTU THERMISTORS LIST (continue)

TM_PREF	THERMISTOR NAME	DESCRIPTION	Type	Unit Location	Figure
A5110	CCD_TEMP	STR CCD temperature	H	STR HEAD	
A5111	OPTICS_TEMP	STR Optics temperature	H	STR HEAD	
A5147	ELECT._TMP_IMU-R	Temperature of electronics unit IMU roll control	L	IMUE	
A5148	SENSOR_TMP_IMU-R	Temperature of electronics unit IMU roll control	L	IMUE	
A5169	ELECT._TMP_IMU-Y	Temperature of electronics unit IMU yaw control	L	IMUE	
A5170	SENSOR_TMP_IMU-Y	Temperature of electronics unit IMU yaw control	L	IMUE	

Table 4.6: thermistors connected on AOCS HOUSE KEEPING (H/K)

4.1 THERMISTORS INSTALLATION LAYOUTS

The installation of thermistors is made by means of EC2216 or AV138.
The location of thermistor is shown in the following figures; each item is identified by the TM_PREF reported in tables 4.1 and 4.2.



NOTE: ALL THERMISTORS ARE BETATHERM TYPE C.

Figure 4.1 (a): THERMISTORS INSTALLATION ON IBIS TRP.

NOTE: ALL THERMISTORS ARE BETATHERM TYPE D

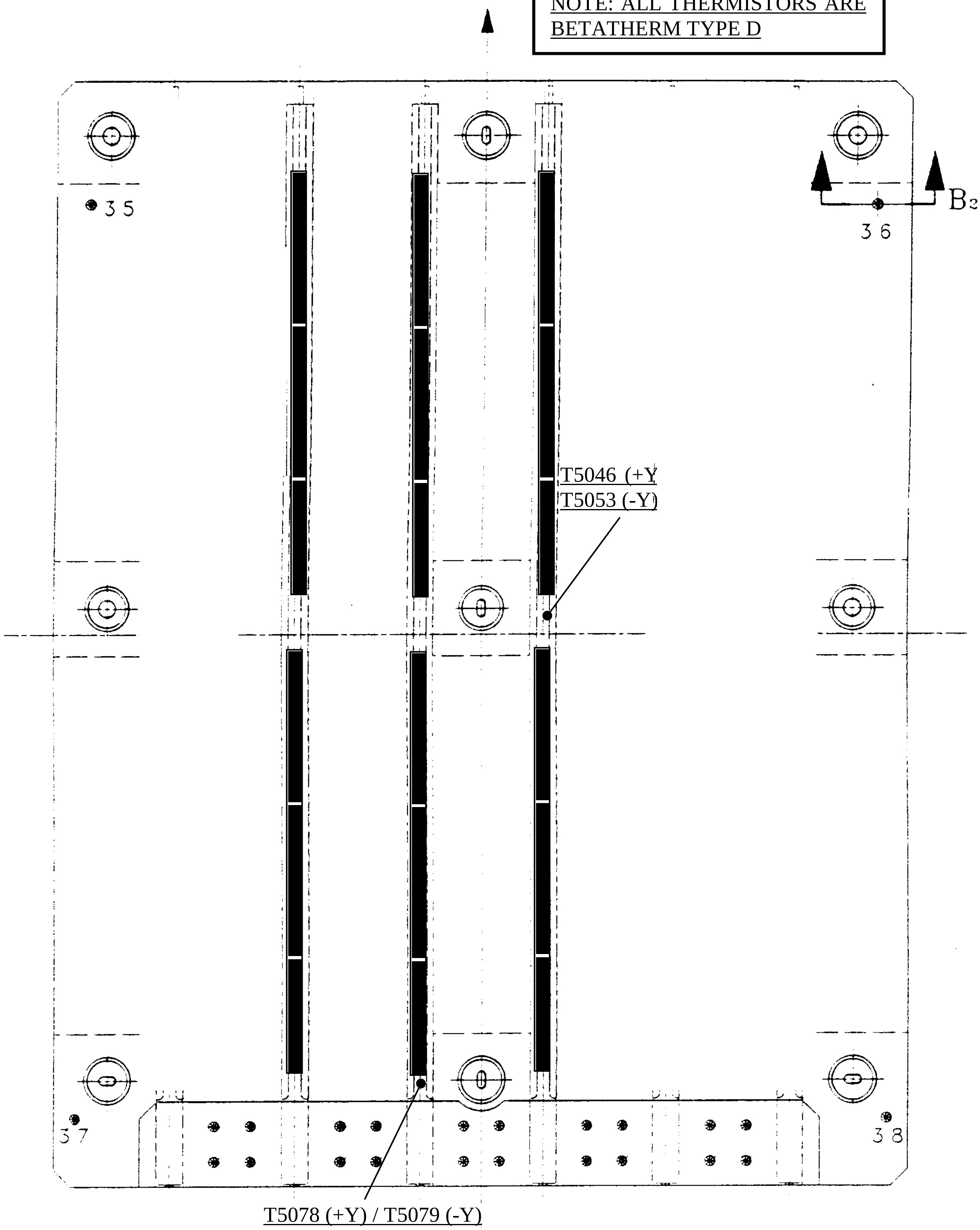


Figure 4.1 (b): THERMISTORS INSTALLATION ON TCA RADIATORS (BETATHERM TYPE D) .

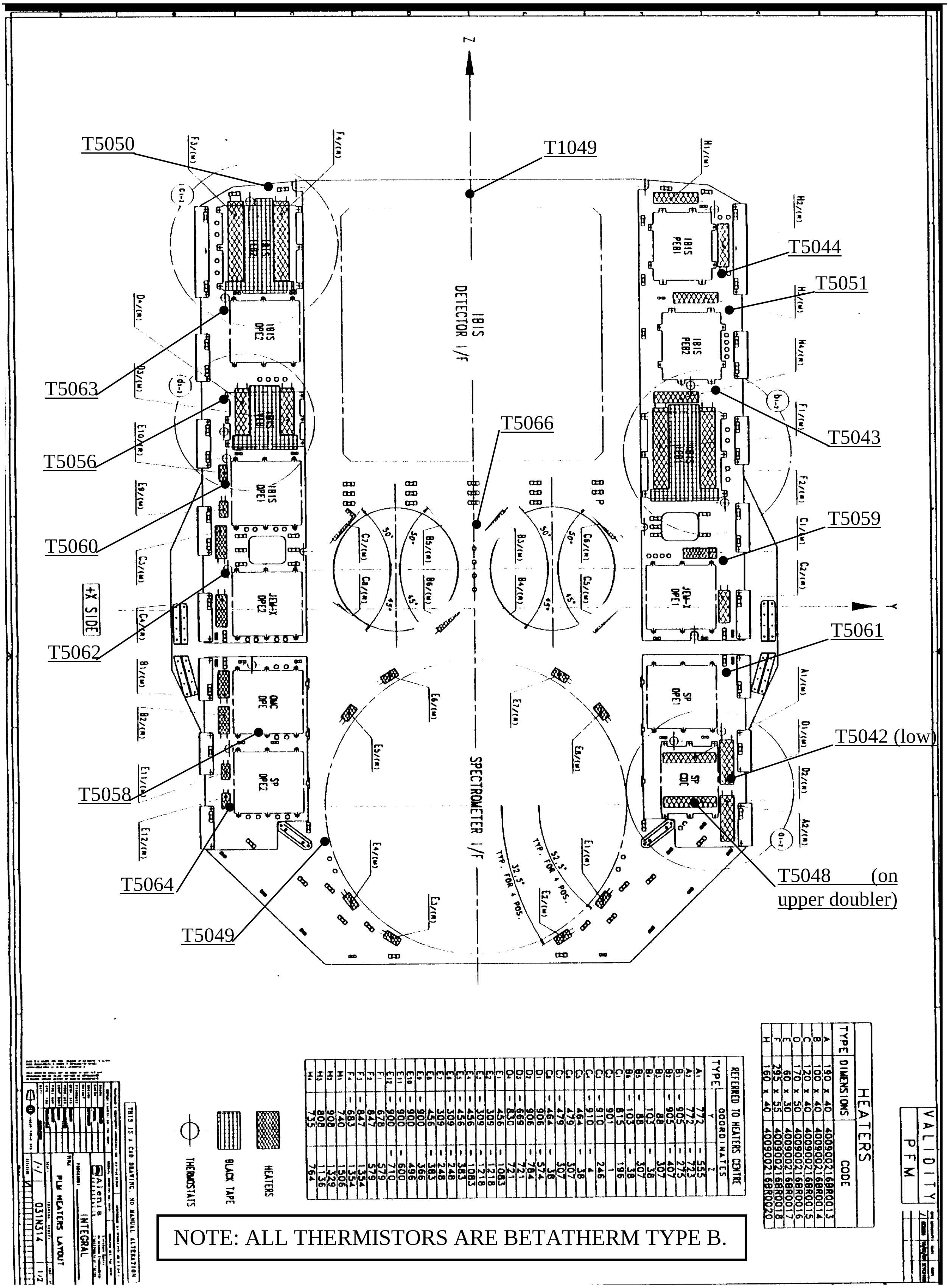


Figure 4.1 (c): PLM DETECTOR BENCH THERMISTORS INSTALLATION.

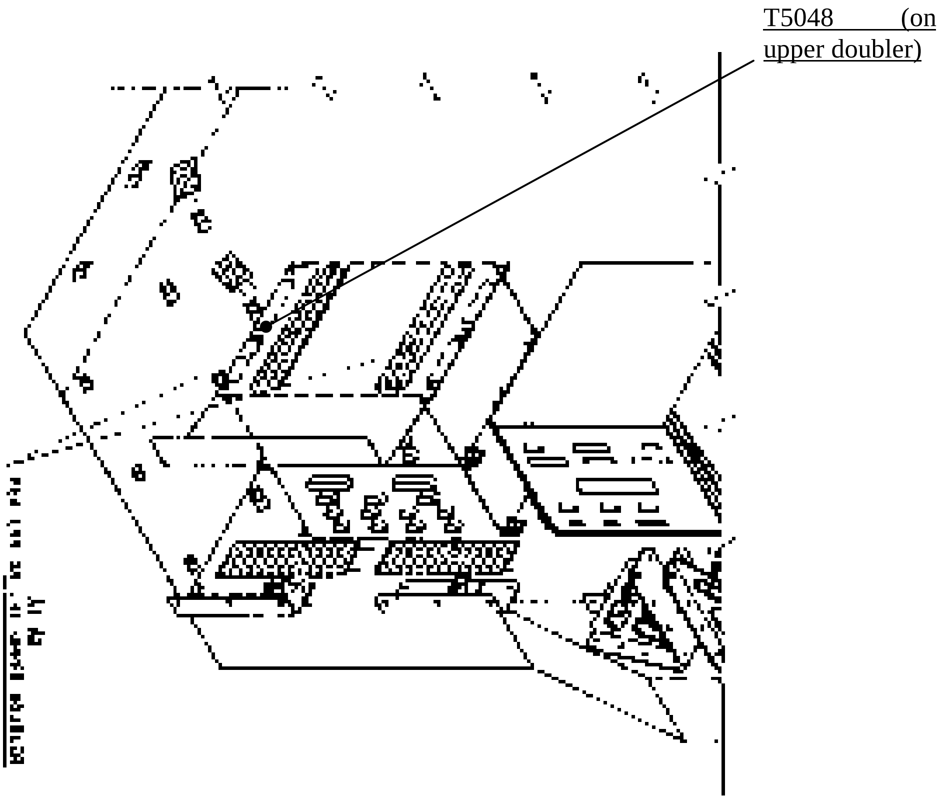
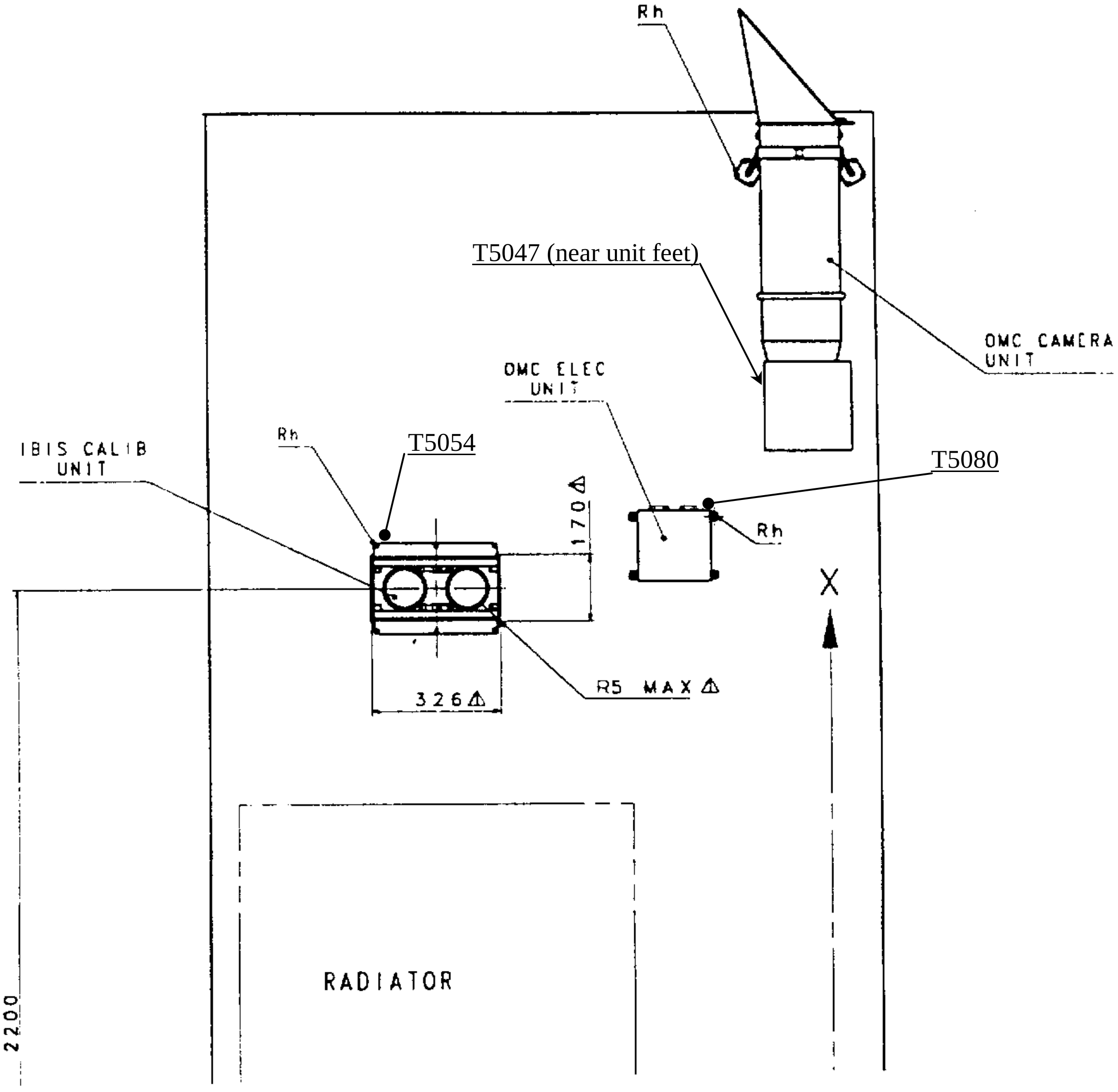
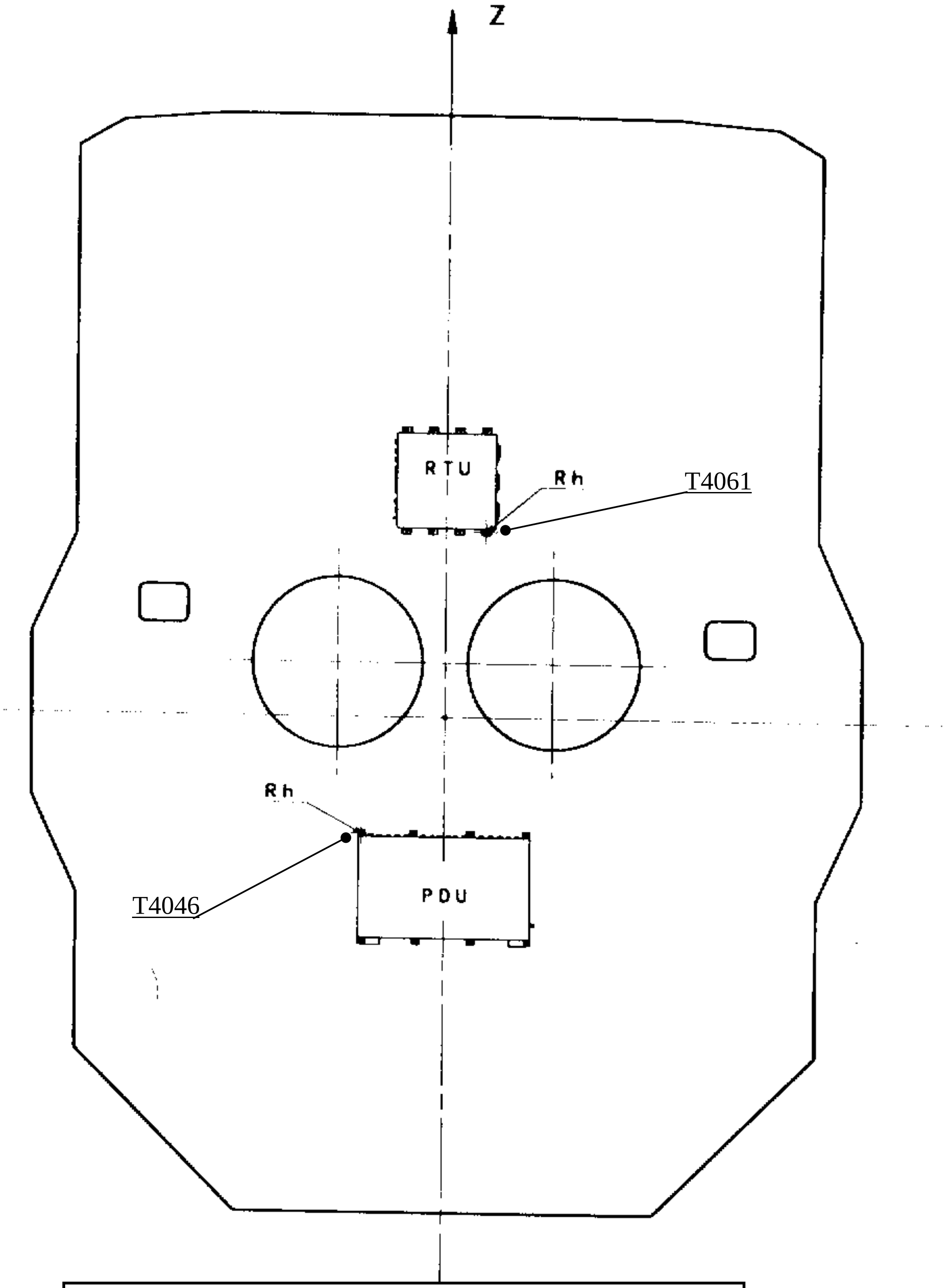


Figure 4.1 (d): DETAIL OF THERMISTOR INSTALLATION ON CDE UPPER DOUBLER.



NOTE: ALL THERMISTORS ARE BETATHERM TYPE C.

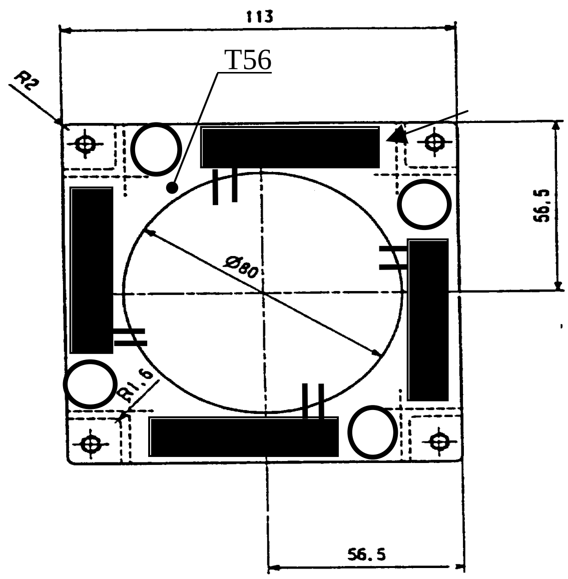
Figure 4.1 (e): THERMISTORS INSTALLATION ON OMC CAMERA TRP, OMC ELECTRONIC AND CALIBRATION UNIT.



NOTE: ALL THERMISTORS ARE BETATHERM TYPE B.

Figure 4.1 (f): THERMISTORS INSTALLATION ON PLM PDU AND RTU.

NOTE: THERMISTOR BETATHERM TYPE B.



NOTE: THE THERMISTOR MUST BE INSTALLED ON THE INNER PART OF THE SUPPORT (UNDER THE SAS)

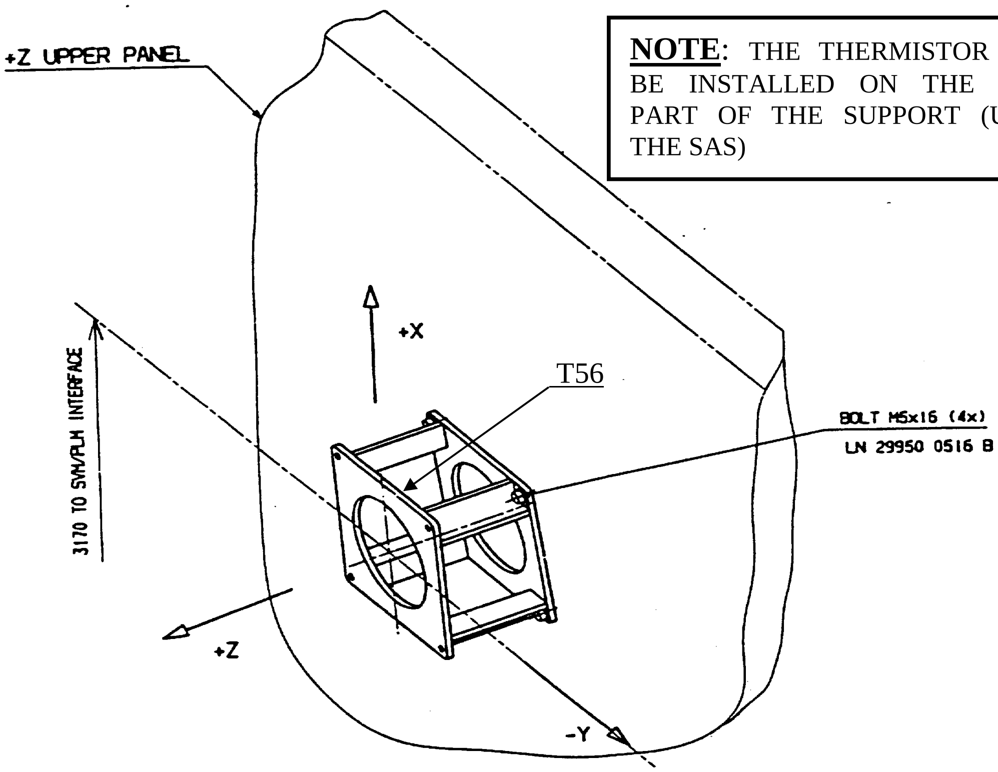


Figure 4.1 (g): THERMISTOR INSTALLATION ON SAS +Z.

NOTE: ALL THERMISTORS ARE BETATHERM TYPE C.

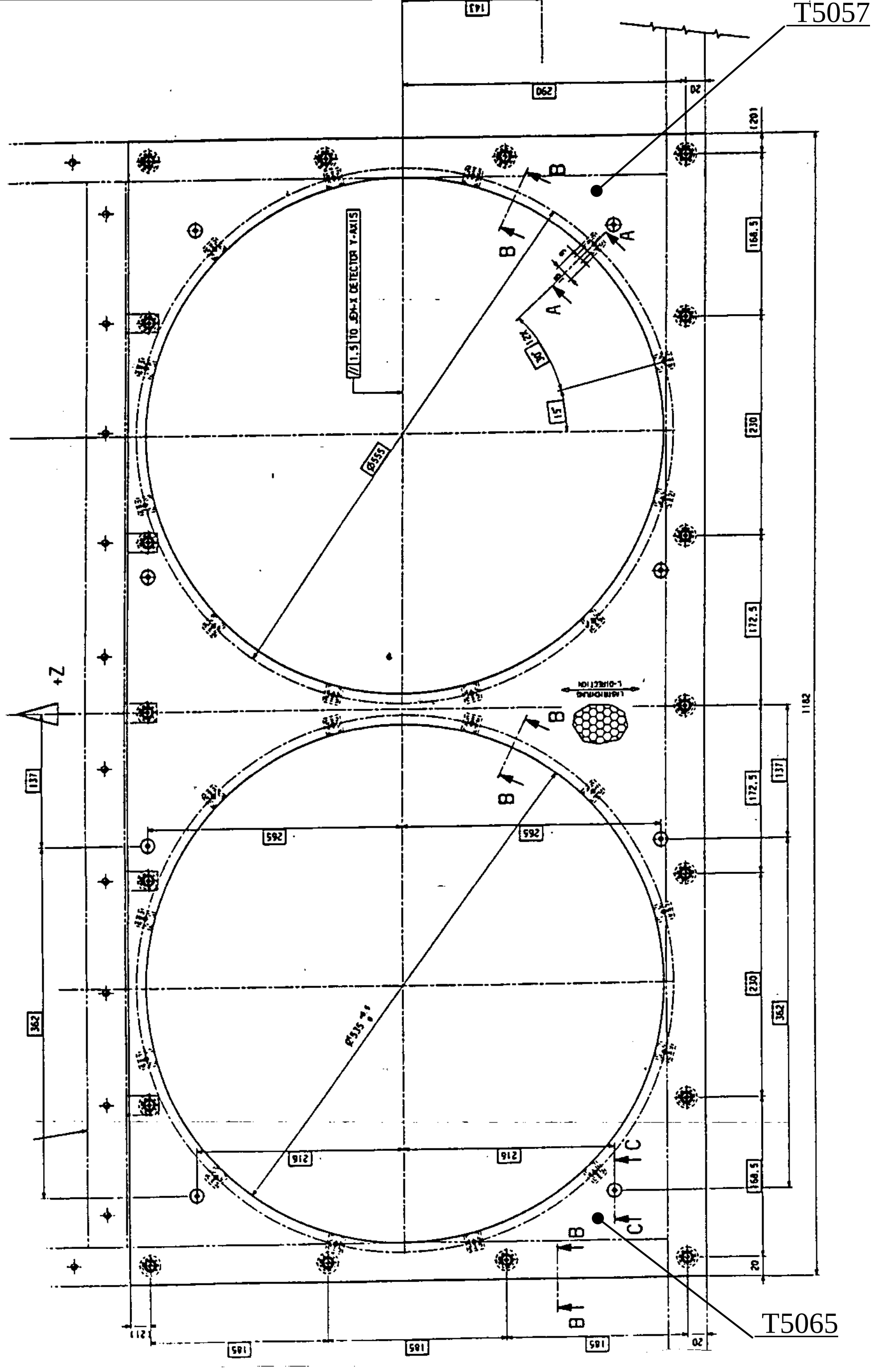
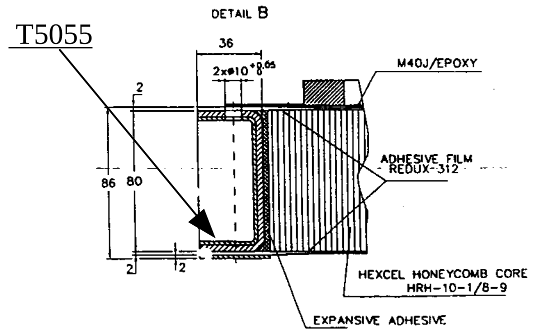


Figure 4.1 (h): THERMISTORS INSTALLATION ON JEM-X MASKS

NOTE: THERMISTOR BETATHERM TYPE C.

NOTE: INSTALL THE THERMISTOR ON THE LOWER PART OF THE +Y FRAME.



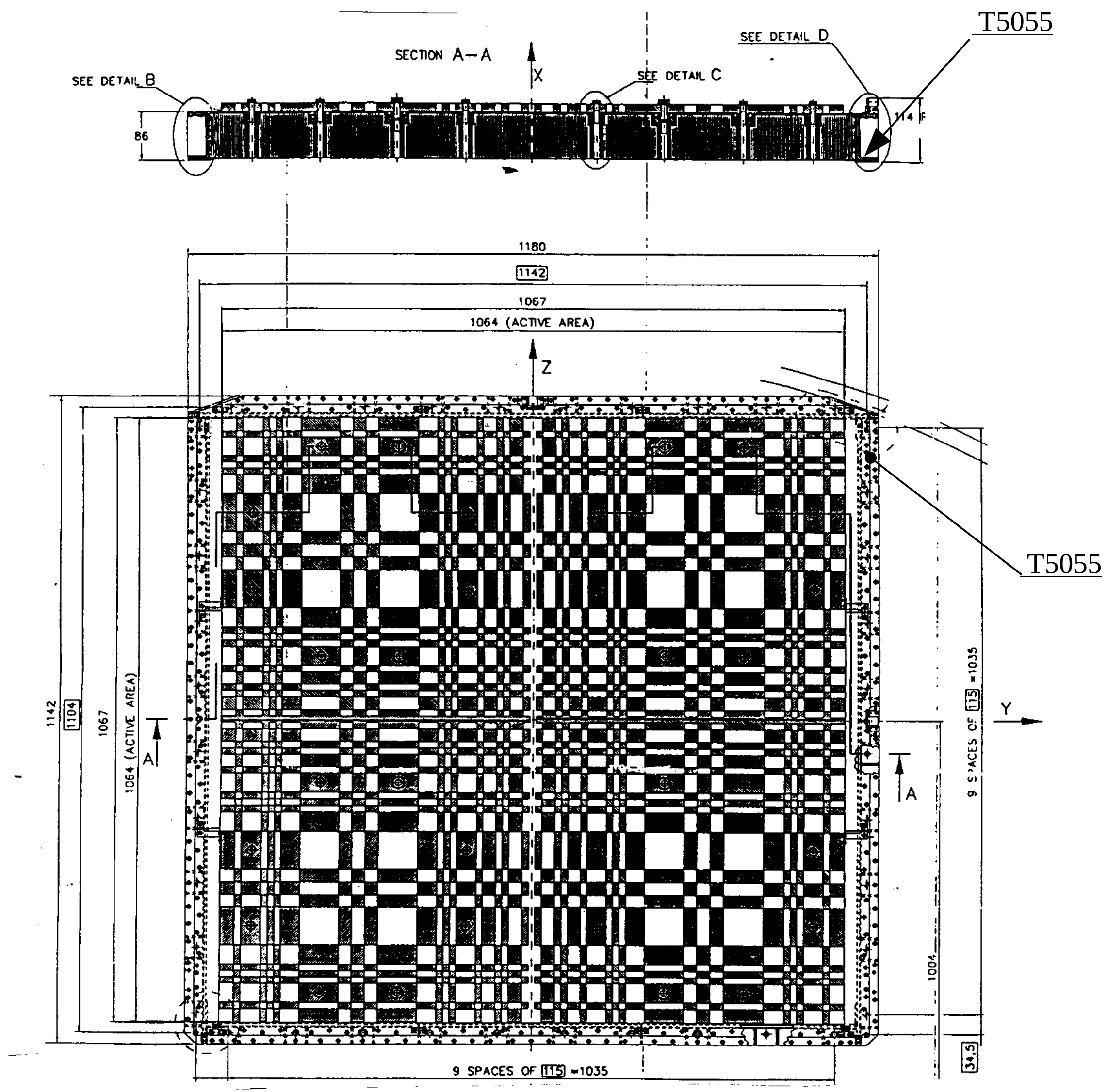


Figure 4.1 (i): THERMISTOR INSTALLATION ON IBIS MASK

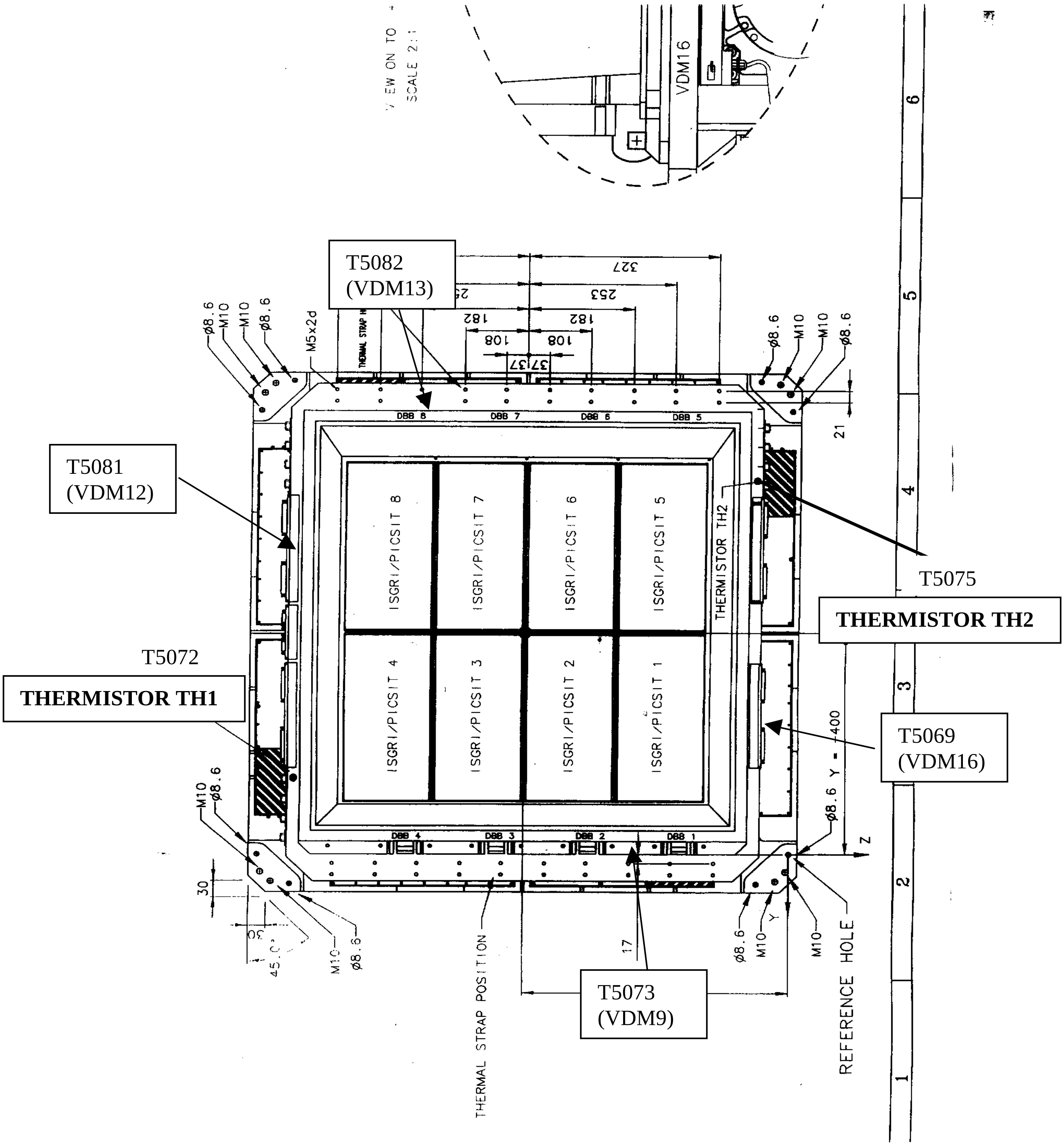


Figure 4.1 (l): (ONLY FOR INFORMATION) THERMISTOR INSTALLATION ON IBIS

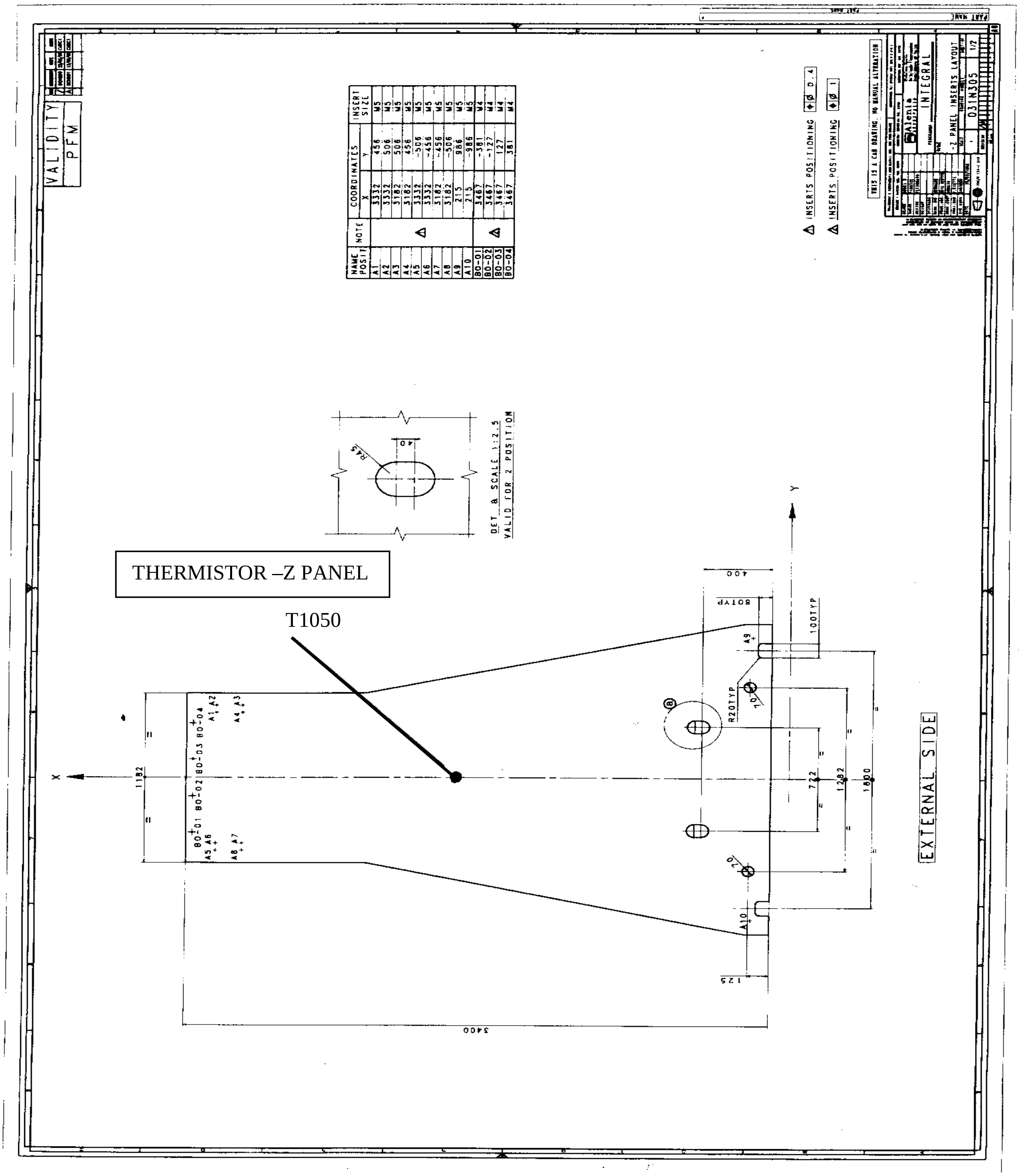


Figure 4.1 (n): THERMISTOR INSTALLATION ON –Z PANEL

NOTE: FOR THERMISTORS INSTALLATION PAY ATTENTION TO HEATERS AND THERMOSTATS, VELCROS AND STAND – OFF (dedicated to MLI)

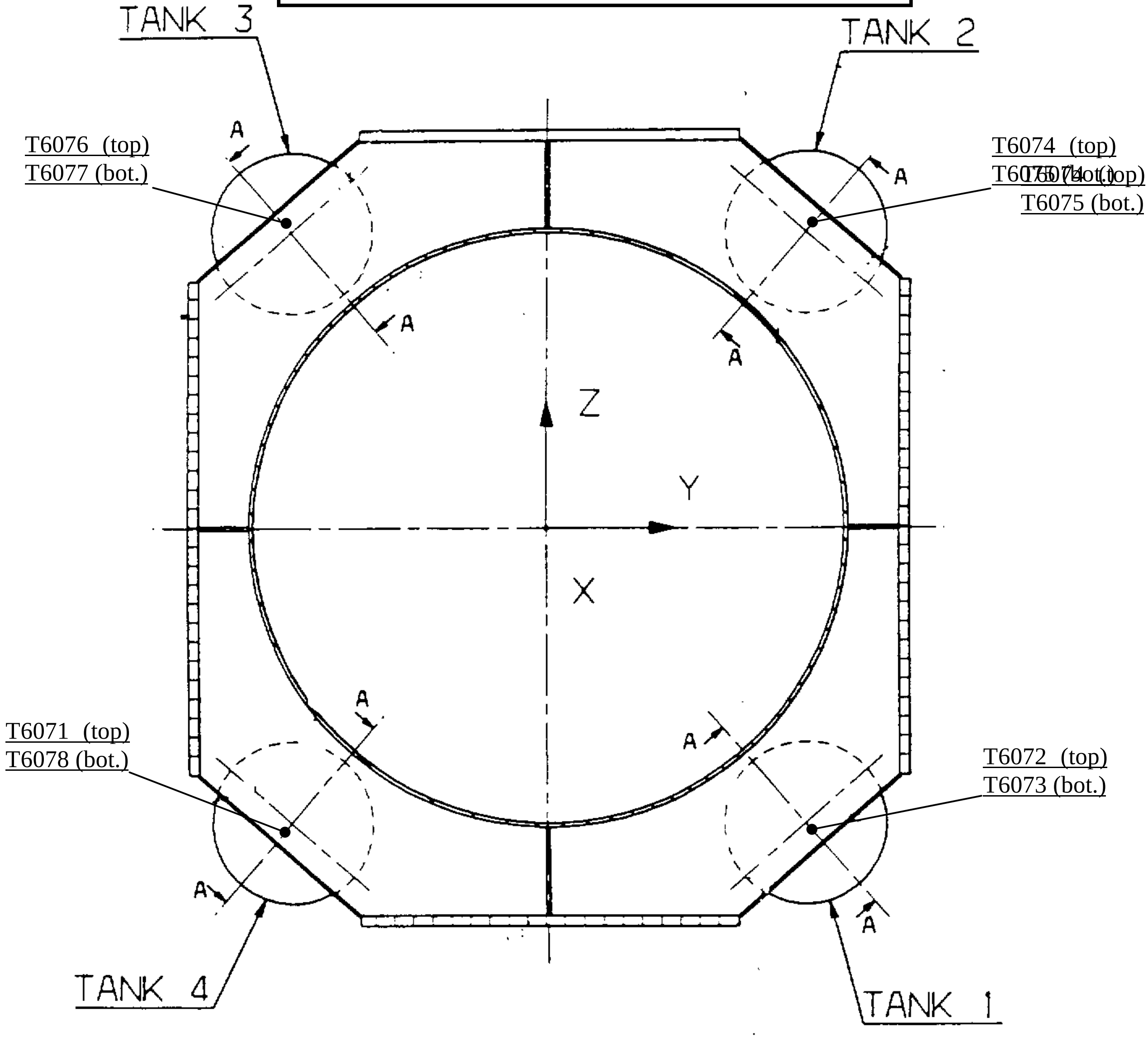
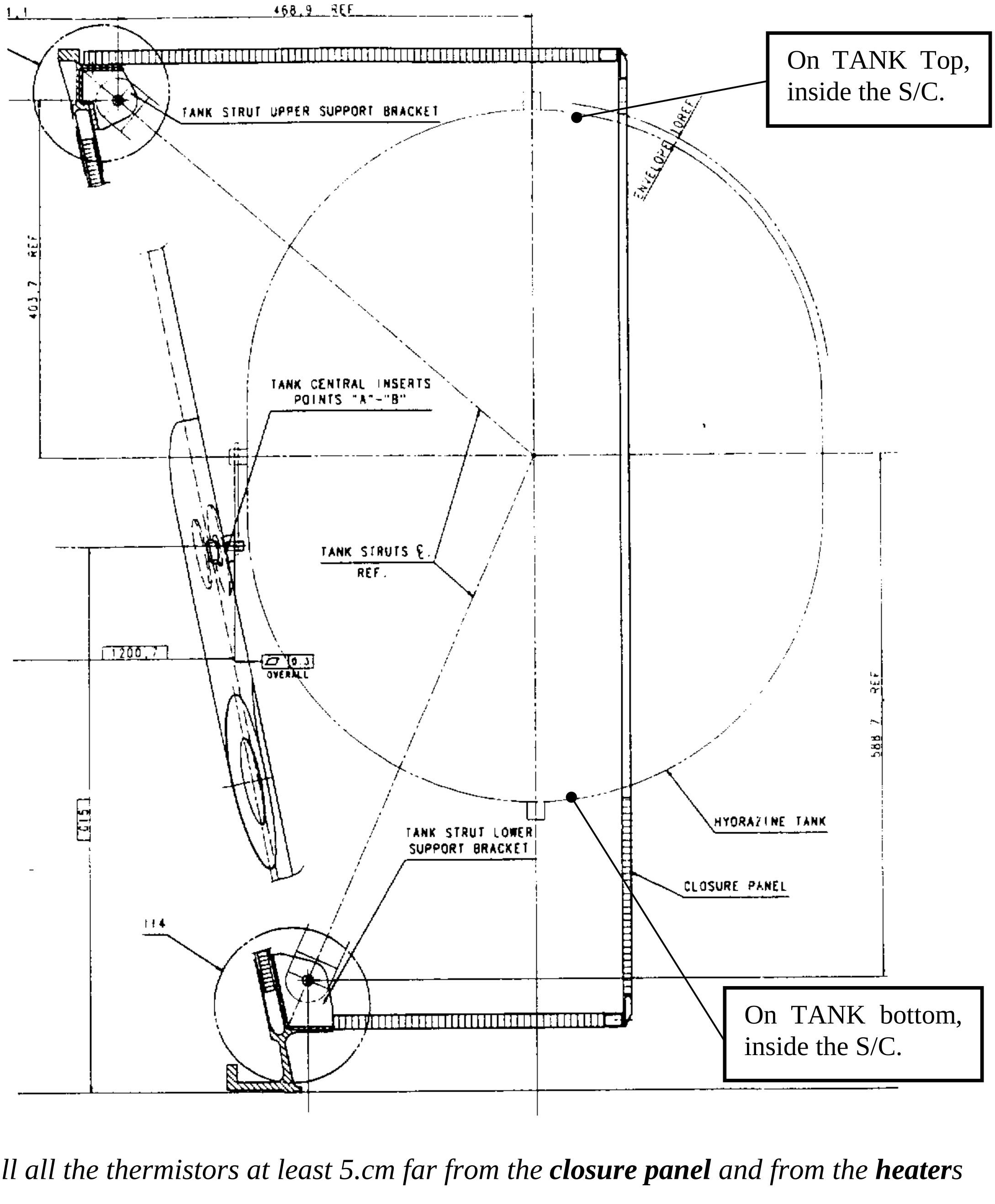


Figure 4.2 (a_1): THERMISTORS INSTALLATION ON TANKS.



*NB: install all the thermistors at least 5.cm far from the **closure panel** and from the **heaters***

Figure 4.2 (a_2): THERMISTORS INSTALLATION ON TANKS.

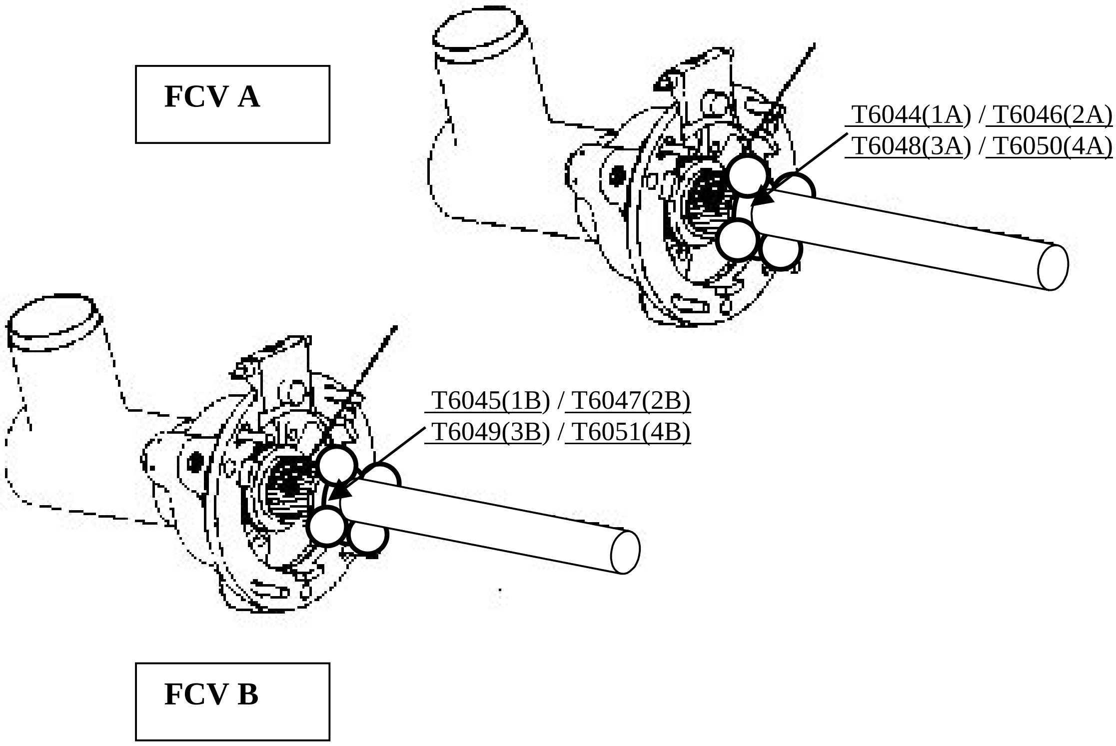
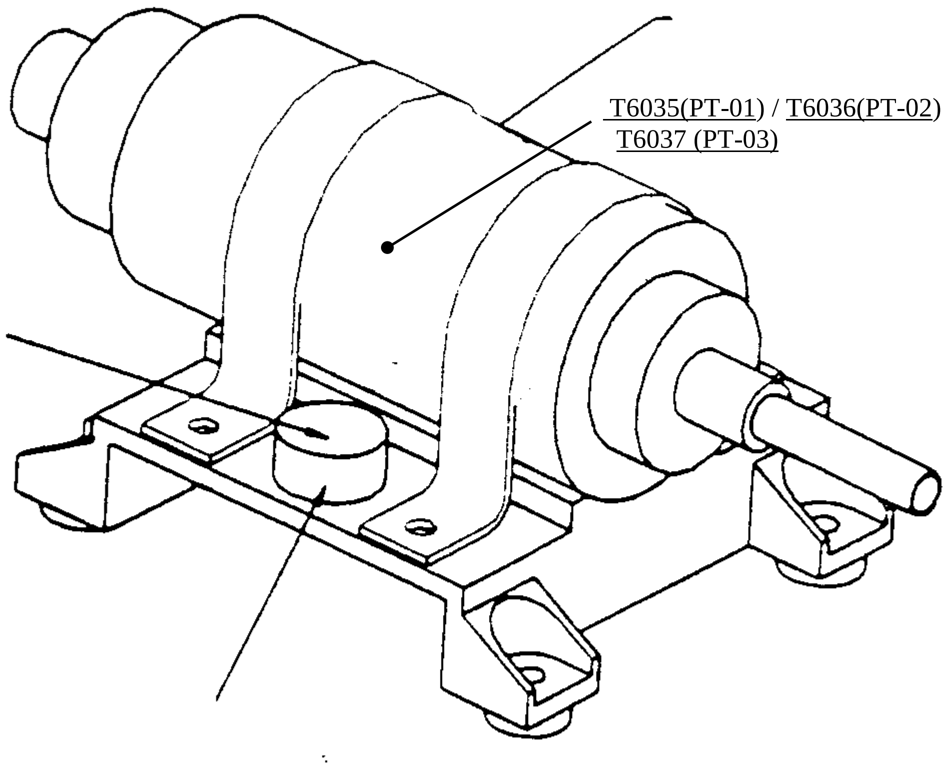


Figure 4.2 (b): THERMISTORS INSTALLATION ON FCV 1/2/3/4.



NOTE: all thermistors on PT have already been installed in BPD.

Figure 4.2 (c): THERMISTORS INSTALLATION ON PT-01/-02/-03.

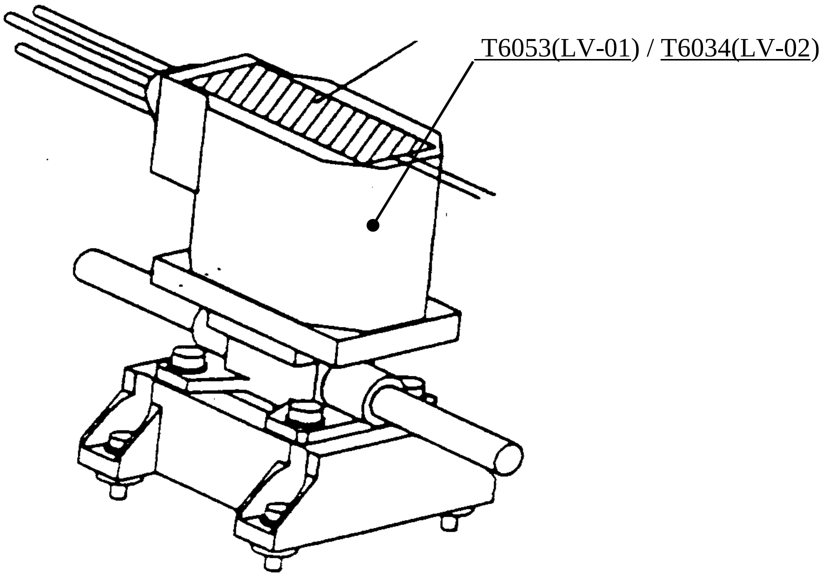


Figure 4.2 (d): THERMISTORS INSTALLATION ON LV-01 AND LV-02.

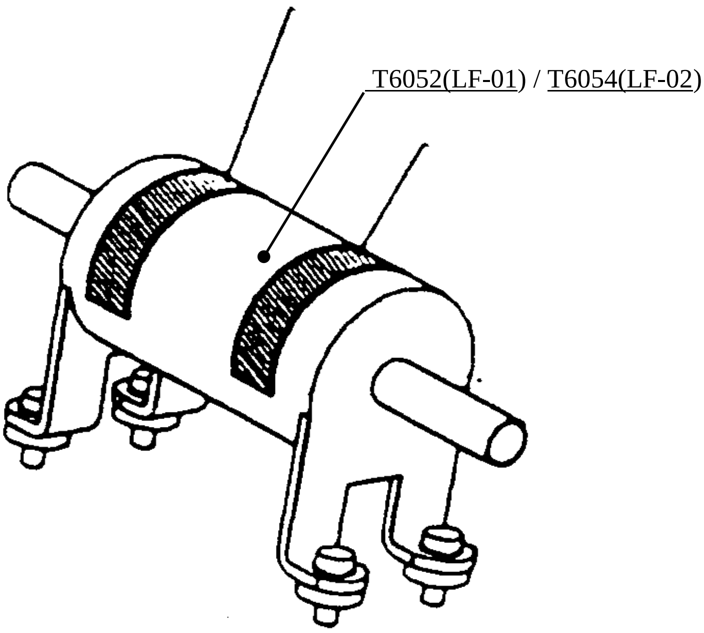


Figure 4.2 (e): THERMISTORS INSTALLATION ON LF-01 AND LF-02.

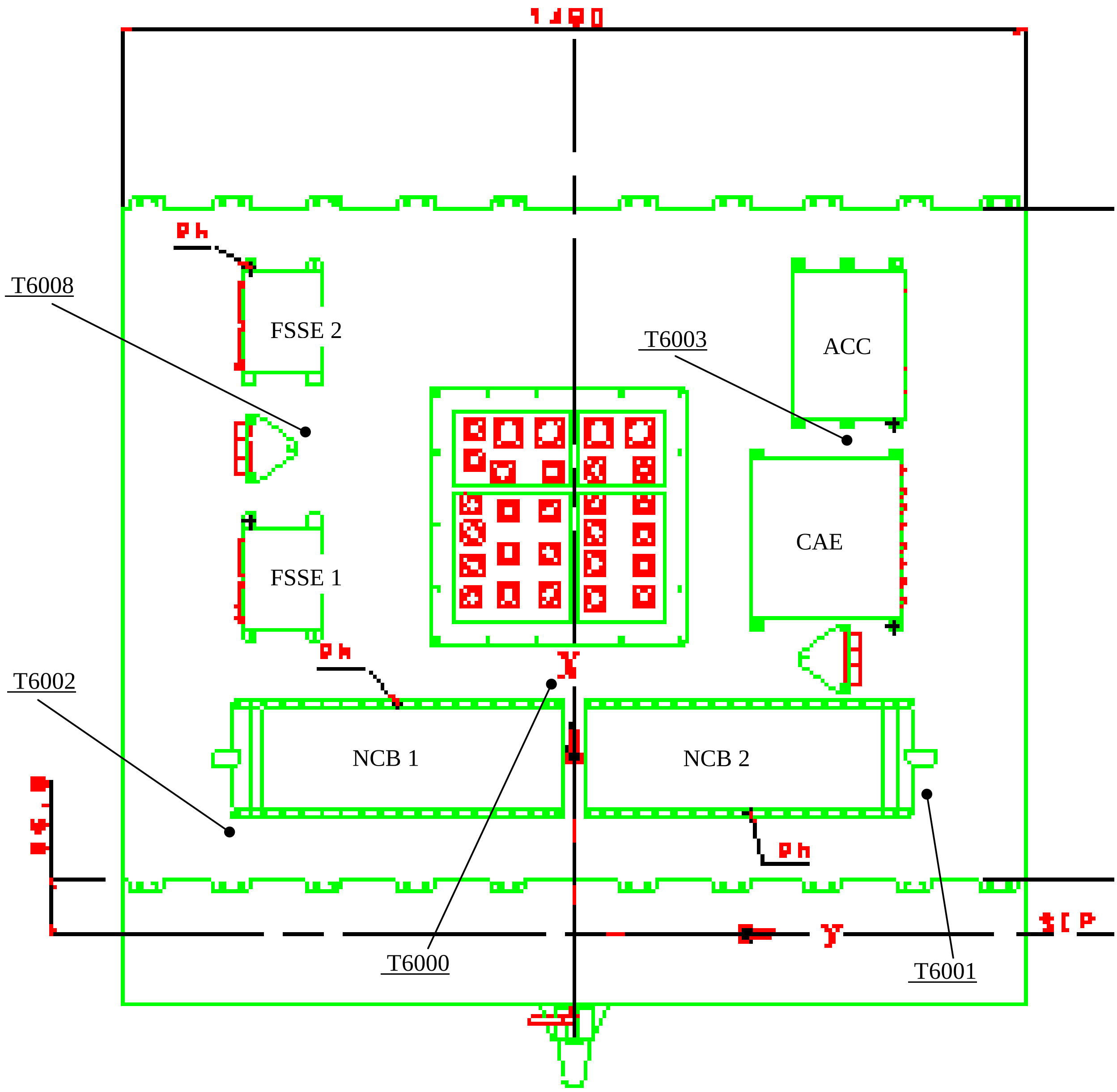


Figure 4.2 (f): THERMISTORS INSTALLATION ON SVM + Z PANEL.

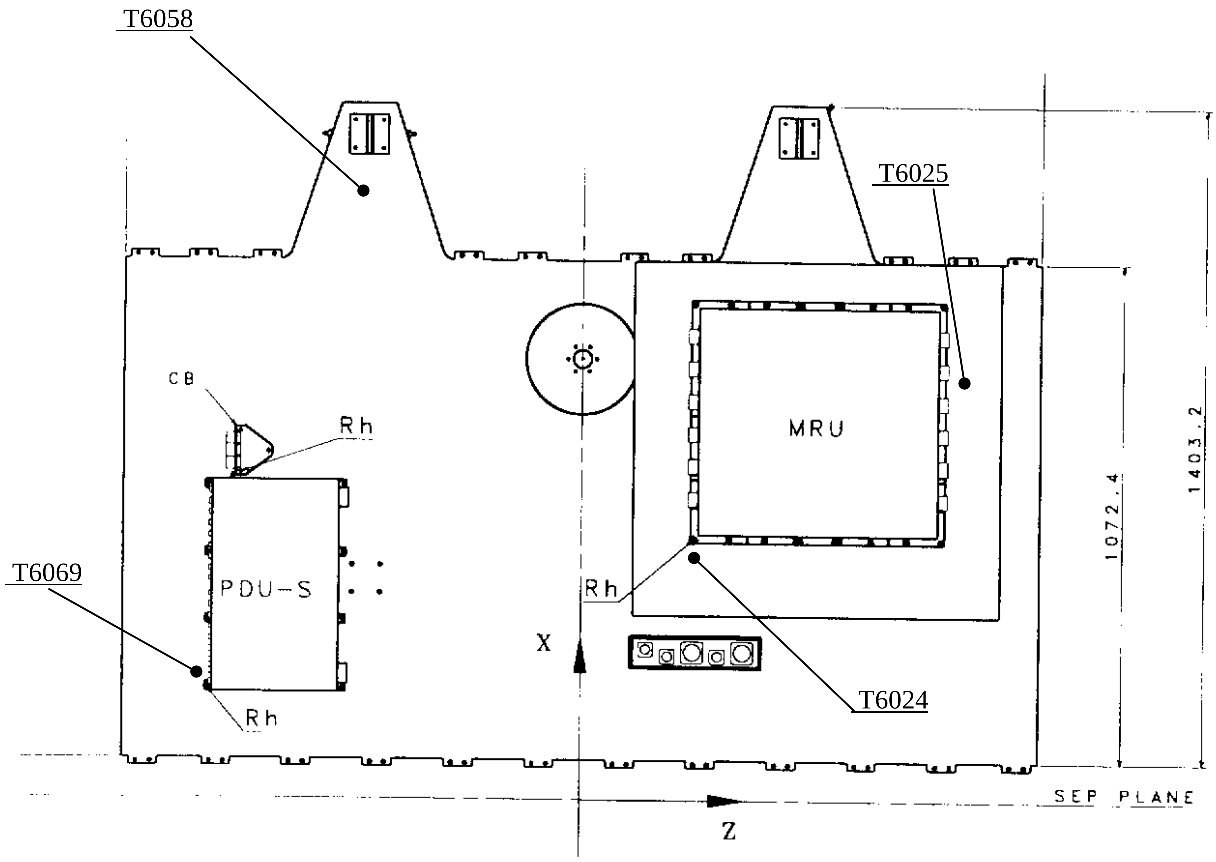


Figure 4.2 (g): THERMISTORS INSTALLATION ON SVM - Y PANEL (MRU, PDU AND SOLAR ARRAY HOLD DOWN).

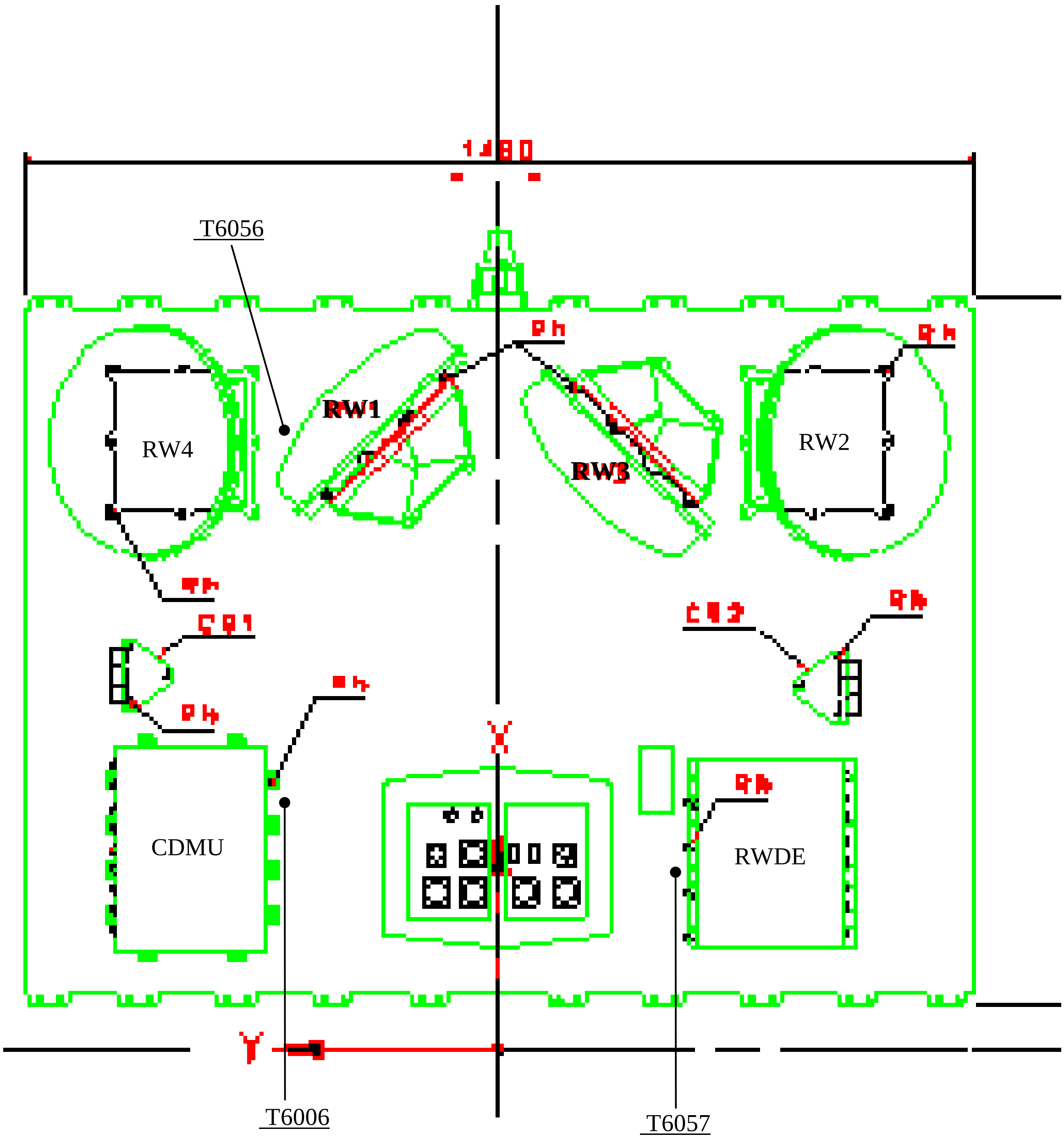


Figure 4.2 (h): THERMISTORS INSTALLATION ON SVM -Z PANEL.

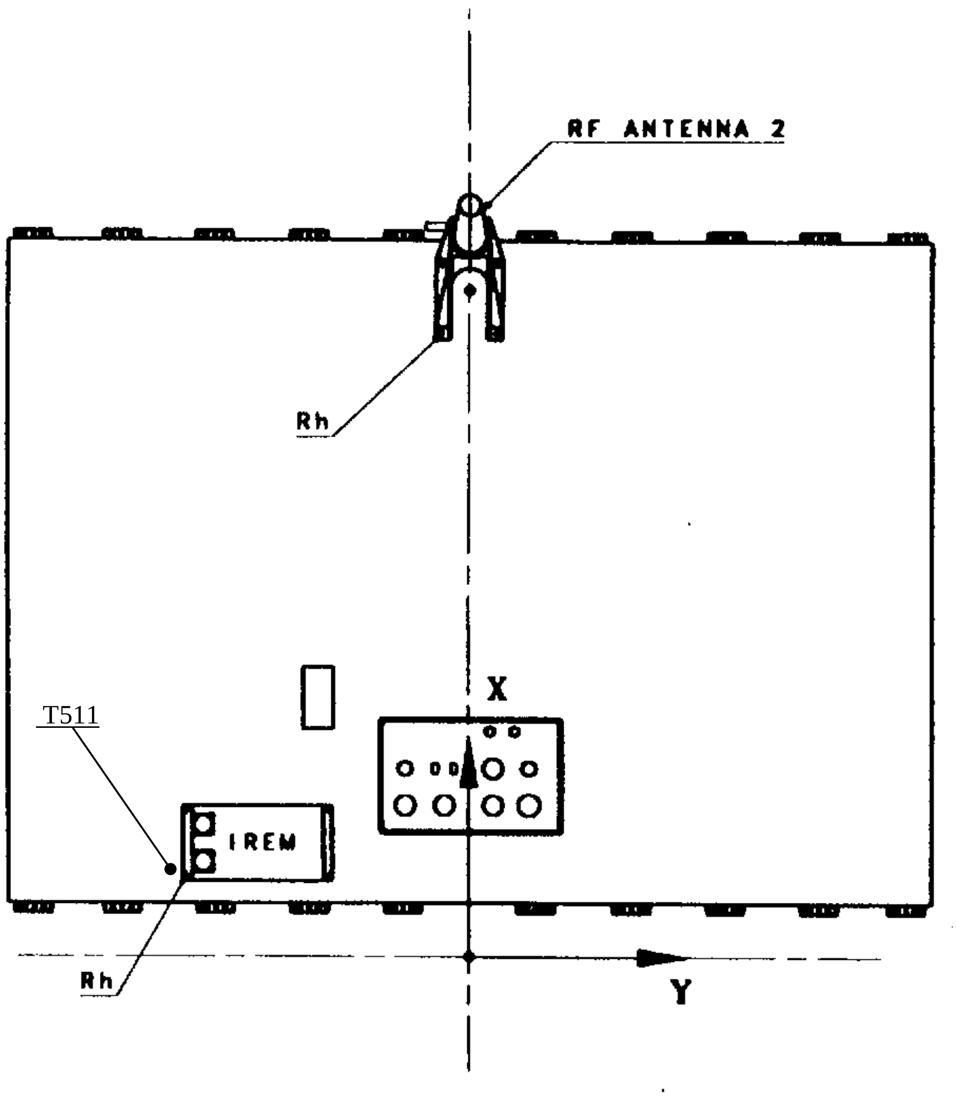


Figure 4.2 (i): THERMISTORS INSTALLATION ON IREM.

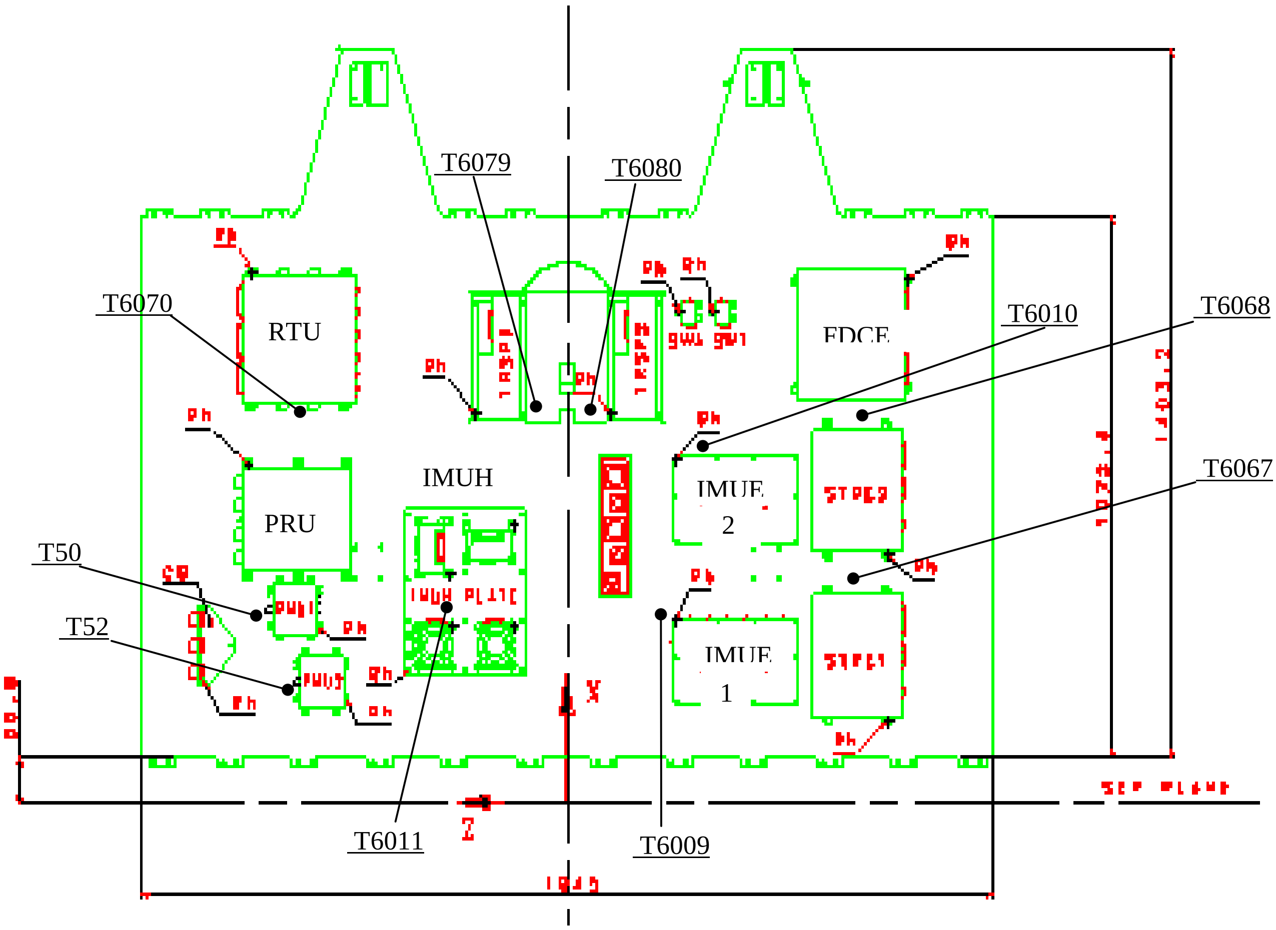


Figure 4.2 (l): THERMISTORS INSTALLATION ON SVM + Y PANEL.

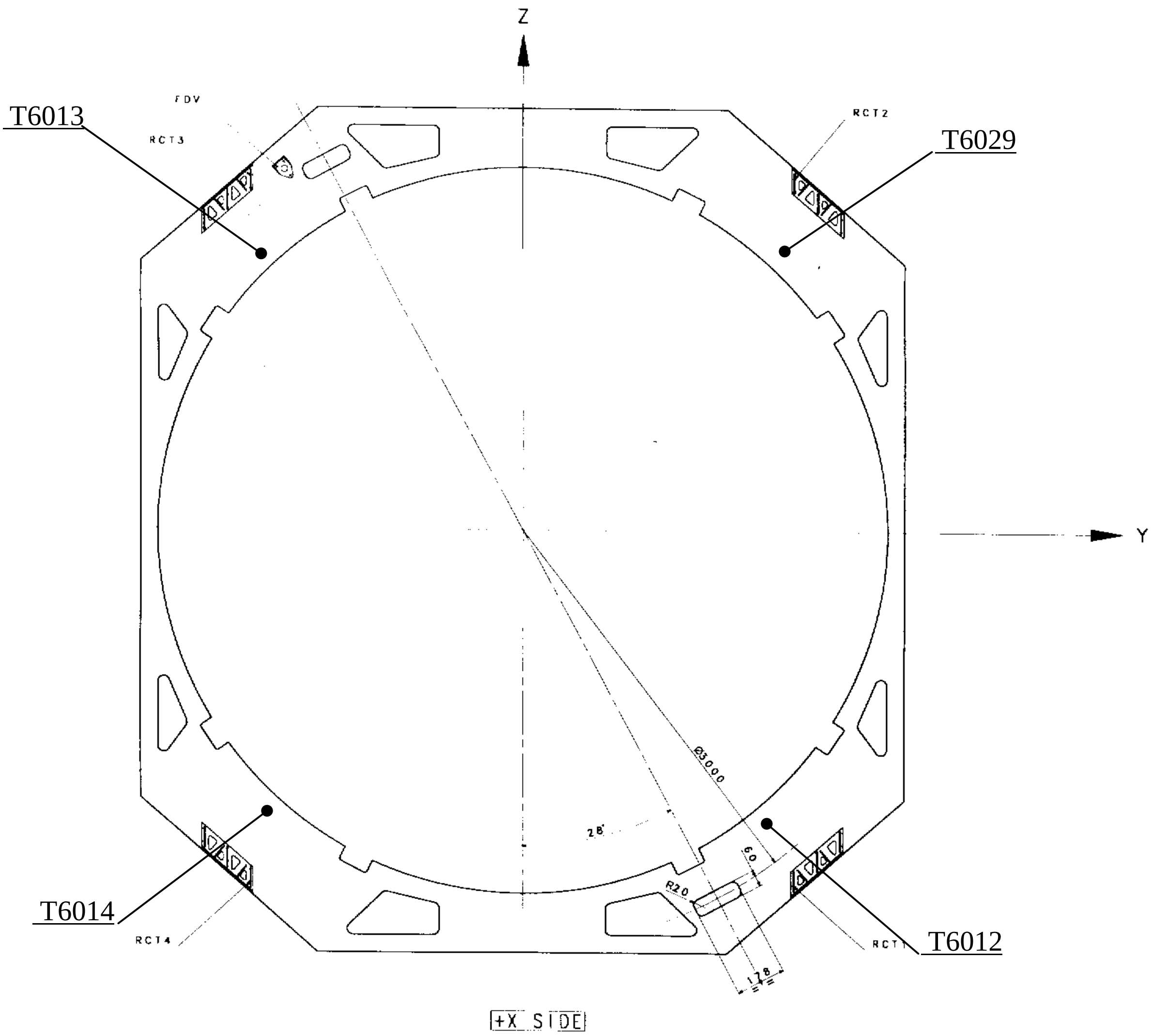


Figure 4.2 (m): THERMISTORS INSTALLATION ON SVM LOWER PLATFORM.

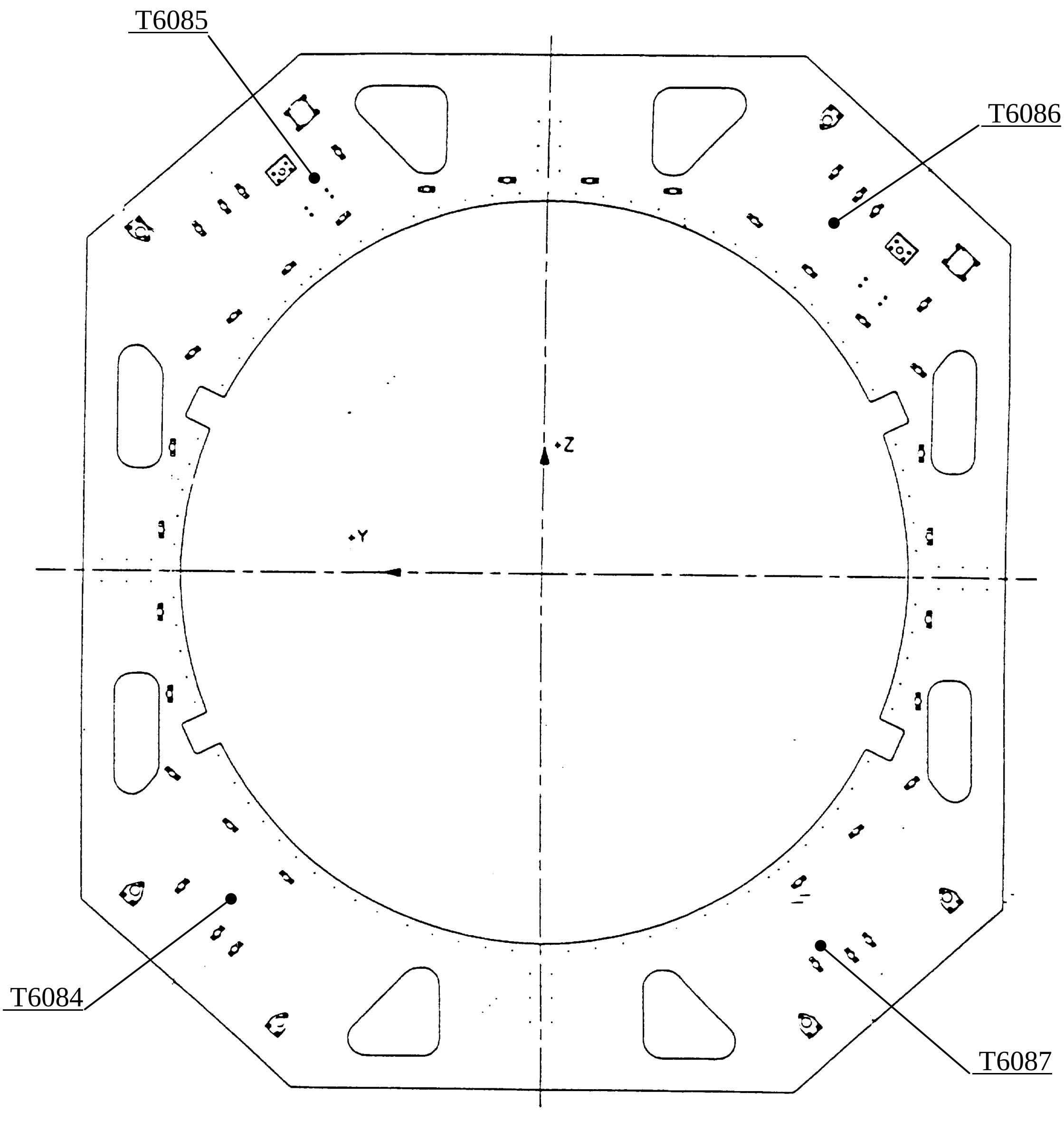


Figure 4.2 (n): THERMISTORS INSTALLATION ON SVM UPPER PLATFORM.

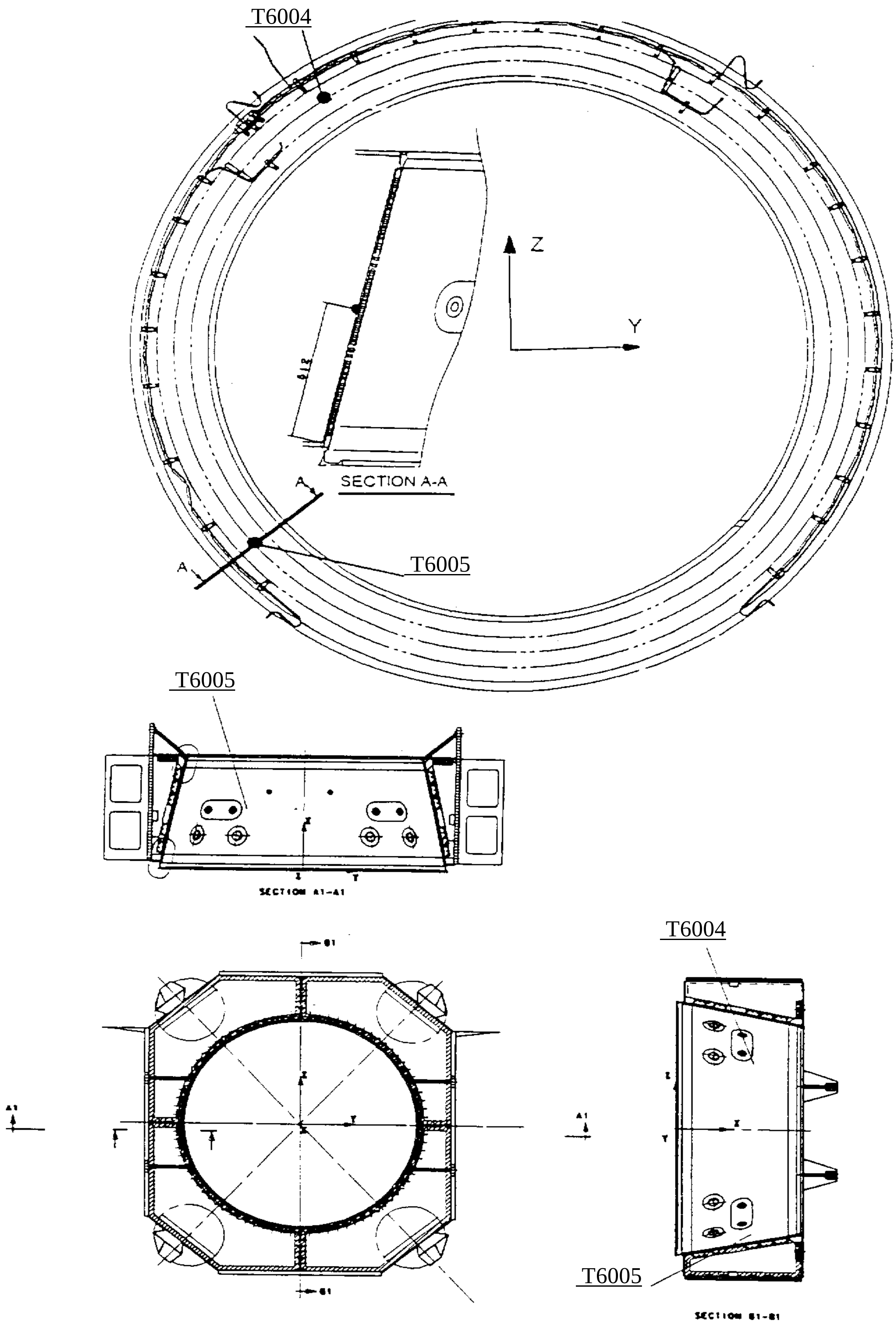


Figure 4.2 (o): THERMISTORS INSTALLATION ON CENTRAL CONE.

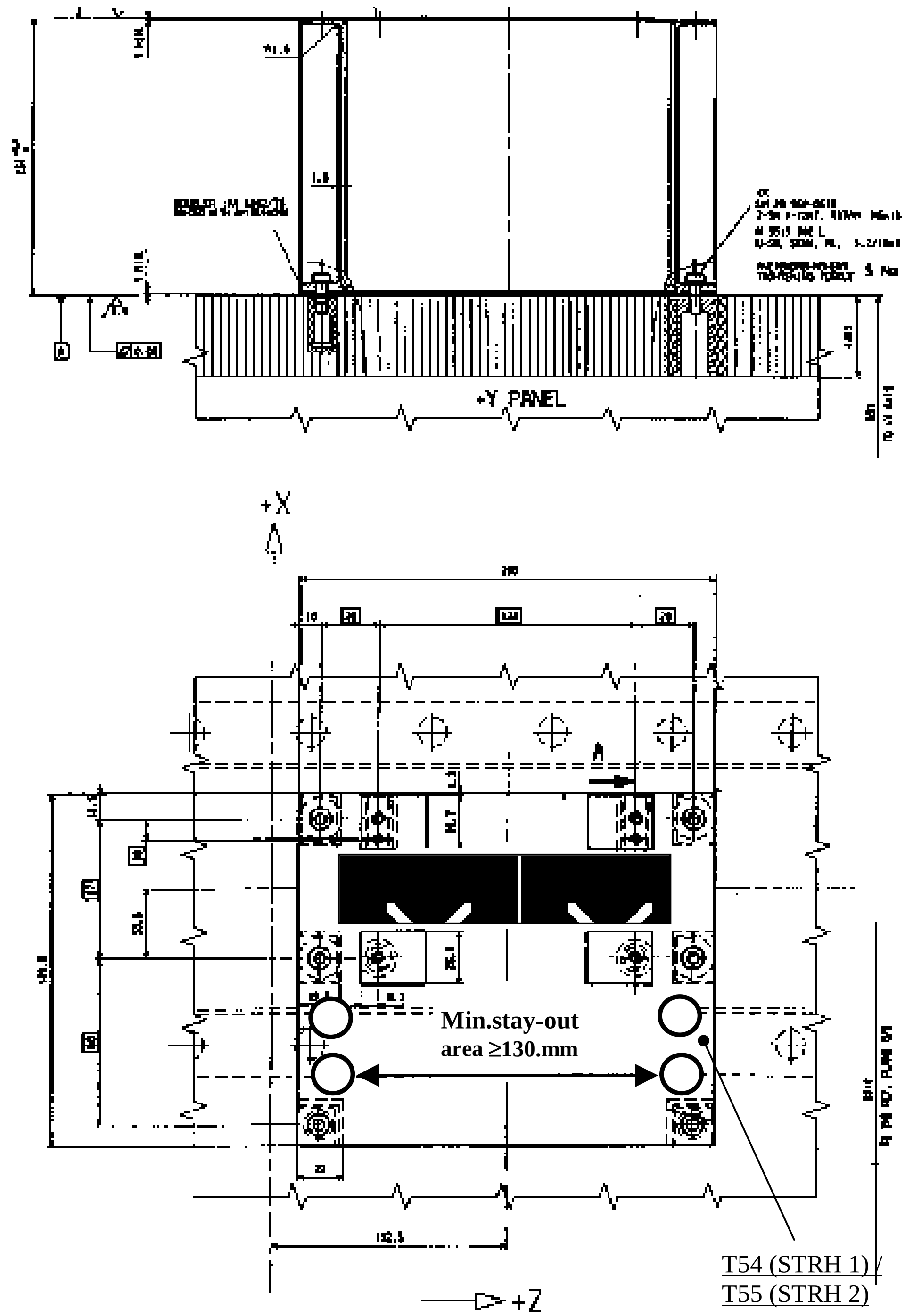


Figure 4.2 (p): THERMISTORS INSTALLATION ON STRH 1 & 2.

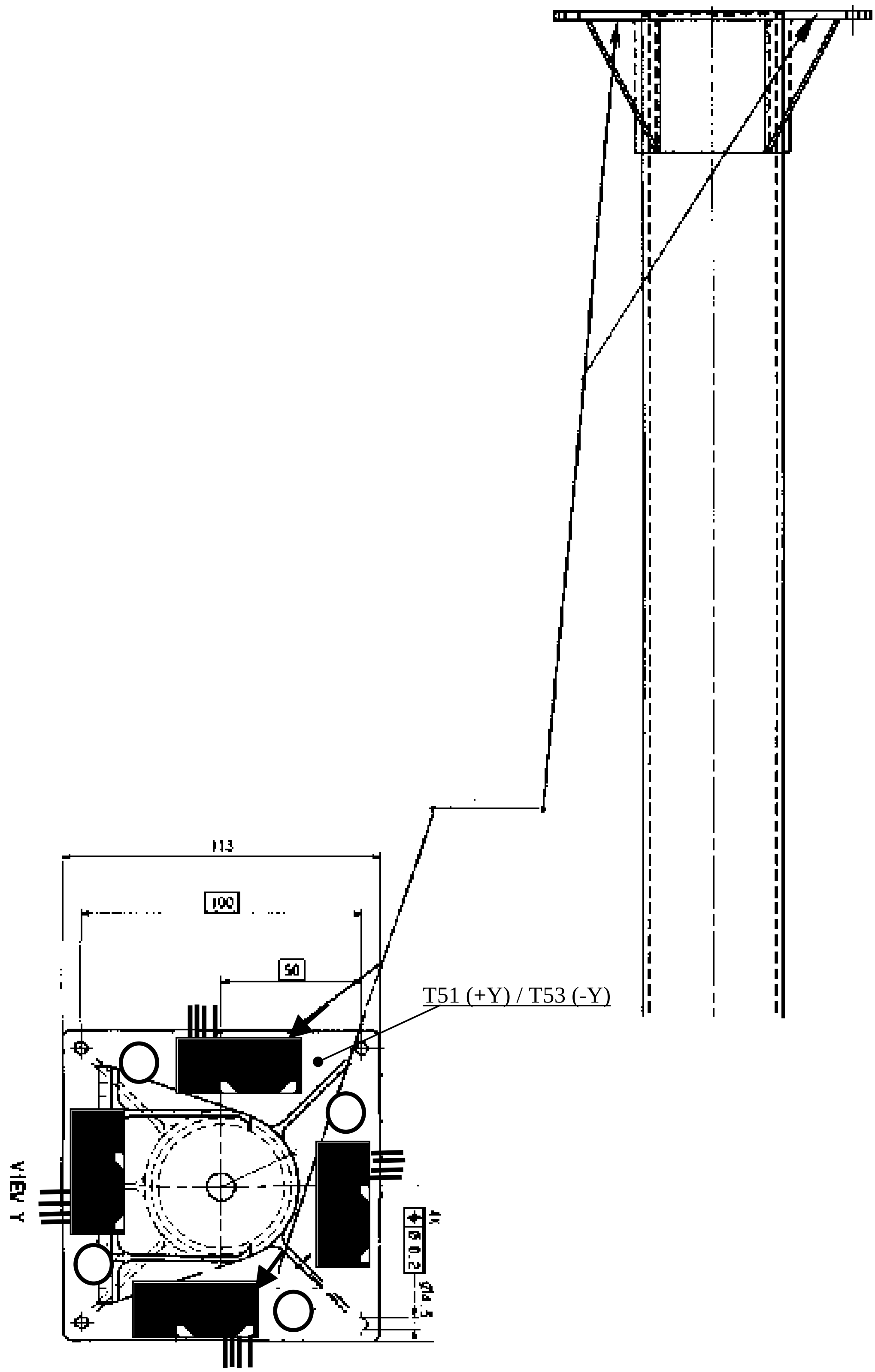


Figure 4.2 (q): THERMISTORS INSTALLATION ON SAS +Y (T51) AND –Y (T53).

5. HEATERS

5.1 TCS HEATERS

The type, part number, quantity and characteristic of thermofoil heaters used for INTEGRAL TCS are listed in the following table 5.1. For the RCS Clayborn heaters see chapter 8. Resistance tolerance is ± 5 % of nominal value.

Type	PART NUMBER	Quantity (N+R)	HEATER Resistance [Ω]	HEATER Nominal Power @ 26.5V [W]	HEATER Dimensions X [mm]	HEATER Dimensions Y [mm]	REMARKS (used for:)
HTR-A	400900216BR0013	1 + 1	39	18	190.	40.	CDE upper doubler
HTR-B	400900216BR0014	1 + 1	88	8	100.	40.	ODPE
HTR-C	400900216BR0015	2 + 2	64	11	120.	40.	JDPE-1&2
HTR-D	400900203BR0016	2 + 2	35	20	170.	50.	CDE lower, VEB
HTR-E	400900216BR0017	7 + 7	176	4	60.	30.	IDPE-1(-Y),IMUH, SDPE-2 (-Y), SPI
HTR-F	400900216BR0018	2 + 2	24.5	28.7	295.	55.	IBIS IEB-1&2
HTR-G	400900216BR0019	6 + 6	50	7	500.	20.	TCA Radiators ±Y
HTR-H	400900216BR0020	2 + 2	47	15	160.	40.	IBIS PEB-1&2
HTR-J	400900216BR0001	4 + 4	134	5.25	450.	10.	NCB (installed on rails by supplier)
HTR-K	400900203CR0033	4 + 4 + 4	140+140 (#)	5	120.	35.	RWL, IBIS Det. Unit
HTR-L	400900203CR0034	4 + 4	520+520 (#)	1.35	45.	22.	SAS +/-Y
HTR-I	400900216BR0087	2 + 2	470.	1.5	50.	12.	SAS +Z
HTR-M	400900203CR0032	2 + 2	95	7.4	160.	30.	STRH 1&2 (*)
HTR-N	400900203CR0035	6 + 6	350	2	380.	32.	TANK
HTR-P	400900203CR0036	12 + 12	610	1.15	120.	10.	TANK
HTR-Q	400900216BR0053	8 + 8	350	2	45.	16.	FCV (*)
HTR-S	400900203CR0042	2 + 2	303	2.3	75.2	24.6	RCS shunt
HTR-T	400900203CR0041	6 + 6	103	6.8	125.7	22.9	RCS shunt
HTR-U	400900203CR0040	1 + 1	220	3.2	50.	19.8	PT 2 (*)
HTR-V	400900203BR0040	1 + 1	220	3.2	50.	19.8	PT 3 (*)
HTR-W	400900203CR0043	4 + 4	206	3.4	69.9	24.9	LF1&2, LV1&2 (*)
HTR-Y	400900203BR0043	1 + 1	206	3.4	69.9	24.9	RCS shunt
HTR-Z	400900203CR0044	1 + 1	440	1.6	70.	20.	PT 1 (*)
HTR-CH	400900204BR0131	8 + 8	2.5	0.01	170.	6.	On RCS piping
HTR-X	400900203CR0037	4 + 4	350	2.	50.	20.	IMUE + IMUH

NOTE: (*) main and redundant heaters are installed one over the other with an aluminium foil in between (see para. 5.1);
(#) both nominal and redundant heaters have two separate circuits, which can be arranged in different electrical layout (see para 5.2).
The heater HTR-R, installed in the preview issue on IMUE1-2, are not more used. Two of them rimaned on the satellite.

Table 5.1: TCS THERMOFOIL HEATERS SUMMARY TABLES

5.1.1 HEATERS INSTALLATIONS

Heater installation shall follow the relevant ALENIA procedure SG-PR-AI-121 (ref. AD(1)).
According to the procedure, at the end of the connection activity of all elements of each circuit, it is requested to:

- verify the equivalent resistance of the whole circuit
- verify the insulation between the circuit and the structure
- in case of heater with two separate circuits it is requested to verify the electrical insulation between the two separate circuits.

NOTE: in case of thermostats which remain open at ambient temperature (most of all have a very low closing temperature), the circuit check after their installation can be made only after cooling down them.

5.1.1.1 Particular cases

In some cases there is not enough space to install both main and redundant heaters. So it is necessary to install them one over the other with the interposition of an aluminium foil (CHO-FOIL) as it has been done for XMM.
The INTEGRAL S/C heaters installed in this way are:

- under STAR TRACKER HEADS (STRH, see Fig. 7.15 & 7.16);
- around PRESSURE TRANSDUCERS (PT);
- around LATCHING VALVES (LV)
- FCV.

Everywhere it is possible the aluminium layer must exceed the dimensions of the heater of about 5.mm.

5.1.1.2 TWO SEPARATE CIRCUIT HEATERS

Most of INTEGRAL heaters have a single circuit, but in some cases heaters have two separate circuits which give the possibility to choose between different power dissipations untill they are finally connected.
For RWA (HTR-K), SAS (HTR-L) and RCS (Clayborn), each heater has two separate circuits.
There are the following possible configurations:

- One circuit only is used;
- The two circuits are connected in parallel (see RWA, scheme 7.28);
- The two circuits are connected in series (see SAS, scheme 7.19)
- The two circuits are connected to two separate heater lines (main A and redundant B, see RCS, chapter 8).

So it is requested to verify the insulation between the two separate circuits of each heater type HTR-K and HTR-L before the connection and type Clayborn after the connection.

5.2 OTHER SVM HEATERS

Other SVM heaters are located inside the RCS thruster Catalitic bed, and inside the RWL. All these heater are procured and installed by sub-contractors.

5.2.1 Catalytic bed heater

To heet up the catalytic bed heater before the thruster firing same dedicated heater are mounted all around the thruster body.
For each thruster 4 heaters are installed. Their nominal resistance value is 250 ohm, corresponding to 2.8 Watt at 26.5 Volt.
The +Z catalytic bed heaters are connected differently from the –Z ones.
The complete electrical scheme is reported in fig. 7.24 (c).
From the scheme it can be noted that each thruster has 3 different power line:

- the nominal line
- the redundant line
- the back-up line

each commande by a different LCL.

5.2.2 RWA HEATERS

To maintain the RWL internal temperature above 15º C dedicated heaters are mounted inside the RWL themselves.
These heaters are controlled by the RWE following the temperature reading provided by a dedicate 15 K thermistor [fenwell 15 Kohm, MA-4006-AAB-32B].
The heaters can also be activated directly by a MACS ON/OFF command.
In any case when the the temperatures exceedes the 65º C a thermostatic control switch off the heaters.
The electrical scheme is reported in figure 7.29.
It has to be noted that the heater works only if the relevant RWL is ON.
The nominal heater resistance is 90 Ohm.

5.3 INSTRUMENT HEATERS

In the following paragraphs the heater procured and installed by the Scientific Instrument Responsibles are reported.

5.3.1 IBIS HEATER

The following heater are installed on IBIS (AD 14):

Type	PART NUMBER	Quantity (N+R)	Nominal Power @ 26.5V [W]	Resistance (first + in case redun. Circuit) [Ω]	Heater Dimensions X [mm]	Heater Dimensions Y [mm]	REMARKS See annex E
HTR-a	400900209BR0128	4+4	16.5	42.	287.	33.	IBIS CdTe (on Spider)
HTR-b(1)	400900209BR0126	1+1	15.	47.	137.	42.	IBIS CdTe (on Spider)
HTR-c(1)	400900209BR0127	1+1	15.	47.	137.	42.	IBIS CdTe (on Spider)
HTR-d	400900209BR0129	4*+4*	5.	140+140	295.5	148.	IBIS CsI
HTR-e	400900203CR0037	2+2	4.	350	50	20	IBIS Calibration Unit (operat. Heater)
HTR-kk	400900203CR0033	2+2	5.	140+140	120	35	IBIS Detector Unit (compensat. Heater)

IBIS heaters summary table (provided by Alenia and installed by LABEN)

- = 4 double circuit heaters (4 nominal + 4 redundant)

(1) difference between HTR-b and HTR-c is in the location of endings

5.3.2 OMC HEATER

The following heater are installed on OMC (AD 10):

Type	PART NUMBER	Quantity (N+R)	Nominal Power* @ 26.5V [W]	Resistance (first + in case redun. Circuit) [Ω]	Heater Dimensions X [mm]	Heater Dimensions Y [mm]	LOCATION See annex D
HTR-f	IRCA EFISB596	1+1	0.57	1230.	220.	10.	Top Lens barrel
HTR-g	IRCA EFISB597	1+1	0.57	1230.	210.	20.	Top Lens barrel
HTR-h	IRCA EFISB599	2+2	2.67	263.	155.	7.	Top Lens barrel
HTR-i	IRCA EFISB606	2+2	10.82	64.9	125.	30.	CCD radiator (bake out)
HTR-ff	IRCA ESA4009002408RO165	1+1	1.8	390.	50.	30.	Pre-amplificator

* single heater power

5.3.3 SPI HEATER (AD8, AD9)

The following heaters are installed on SPI:

Type	PART NUMBER	Quantity (N+R double layers)	Nominal Power for each line @ 26.5V [W]	Heater Resistance (first + in case redun. Circuit) [Ω]	Heater Dimensions X [mm]	Heater Dimensions Y [mm]	LOCATION **location are shown in annex F**
HTR-l	Made to mesure	4	10.	265.	circul		Mask thermal control
HTR-m	RS01620339KF	6	24.	162.	100.	125.	ACS LCR ther control
HTR-n	RS02110298KF	6	18.	211.	75.	150.	ACS UCR ther control
HTR-o	RS01390231KF	2	10.	139.	50.	100.	PSD thermal control
HTR-o	RS01390231KF	2	10.	139.	50.	100.	DFEE thermal control
HTR-p	RS00530288KF	4	25.	53.	75.	125.	AFEE1,2 therm control
HTR-q	//	12*	90.	95.	//	//	Compressors heaters power by PLM
HTR-q1	//	10**	90.	79.	//	//	Compressors heaters power by PLM
HTR-r	//	4	45.	74.	//	//	Heat pipes thaw heaters
HTR-s	//	3	15.	145.	//	//	Annealing
HTR-t	//	2	12.	110.	//	//	Anti-freeze1
HTR-u	//	1	6.	110.	//	//	Anti-freeze2
HTR-v	RS01141236KF	6	37.	114.	50.	125.	compensation

* only main
** only redundant

6. TCS LINE CIRCUIT DESCRIPTION (HEATERS + THERMOSTATS)

A TCS heater line is composed of one or more heaters thermally controlled by dedicated thermostats (usually two). They are connected (and electrically feed) to one of the INTEGRAL PDU (PLM or SVM).
In this paragraph each TCS heater line is described in term of heaters and thermostats and the relevant PDU line is identified.

6.1 PLM PDU HEATER LINES

The PLM PDU heater lines are described in the following tables for section A (main) and B (redundant).
For each line, the columns contain:

1) PLM PDU line identification : Board, LCL and TSW
2) Identification label, with the name of the controlled item
3) Heater line power in Watt, calculated at 26.5 V at the heater ends
4) Equivalent Electrical Resistance of the whole Heater line (harness excluded)
5) Type (see also tables 3.1) and identification number of all the ones included in the Line
6) Switching ON- Thermostat Thresholds
7) Switching OFF- Thermostat Thresholds
8) Electrical heaters line configuration (// heaters in parallel ; * heaters in series)
9) Heaters type (see also tables 5.1 and 5.2) and identification number of all the heaters included in the Line
10) Number of the figure showing the location of the heaters and thermostats
11) Number of the table showing the electrical scheme of TCS Line including heater and thermostats.

PPDU ID Bd	L	T	TCS Heat.&Therm. ID. LABEL	Htr Line Power [W]	Equ. Res [Ω]	**Thermostat** Type & ID.n°	Threshold ON	OFF	Line Heaters Config. [Ω]	**Heater** Type & ID.n°	Shown on Figures Location	El. Scheme
4A	1	6	IBIS IEB2 (-Y) (*)	28.7	24.5	TS-B1	-8	-2	24.5	HTR-F3	Fig. 7.1	7.2 (a)
						TS-B2	-8	-2			(a) & (b)	
5A	1	6	IBIS CdTe (1)	48.	14.6	TS-a1	-21	-15	42//42//47	HTR-a1, HTR -a2	Annex E	Annex E
			(for information only)			TS-a2	-21	-15		HTR -b1	Fig. E1-1	Fig. E2.1
5A	2	6	IBIS CsI	40.	17.5	TS-a3	-21	-15	140//140//	HTR-d1, HTR-d2,	Annex E	Annex E
			(for information only)			TS-a4	-21	-15	140//140//	HTR-d3, HTR-d4,	Fig. E1-1	Fig. E2.2
									140//140//	HTR-d5, HTR-d6,		
									140//140	HTR-d7, HTR-d8,		
6A	2	6	IBIS CdTe (2)	48.	14.6	TS-a5	-21	-15	42//42//47	HTR-a3, HTR –a4	Annex E	Annex E
			(for information only)			TS-a6	-21	-15		HTR –b2	Fig. E1-1	Fig. E2.3
6A	2	5	IBIS Det. Unit	20.	35.	TS-C3	-3	+3	140//140//	HTRkk1,HTR – kk2	Annex E	Annex E
			(for information only)						140//140		Fig. E1-2	Fig. E2.4
6A	1	1	SPI I/F	16	43.9	TS-B3	-8	-2	176//176//	HTR-E2, HTR-E4,	Fig. 7.1	7.3 (a)
						TS-B24	-8	-2	176//176	HTR-E6, HTR-E8		
6A	1	2	CALIBRATION	4	175	TS-c1	-30	-24	350//350	HTR-e1,HTR-e2	Annex E	Annex E
			UNIT			TS-c2	-30	-24			Fig. E1-3	Fig. E2.5
6A	1	3	JDPE2 (-Y)	11	64	TS-B4	-8	-2	64	HTR-C3	Fig. 7.1	7.4 (a)
						TS-B5	-8	-2				
6A	1	4	IBIS VEB (*)	20	35.	TS-B6	-8	-2	35.	HTR-D3	Fig. 7.1	7.5 (a)
						TS-B7	-8	-2			(a) & (b)	

NOTE: (*) both main and redundant heater must be installed below the unit.

Table 6.1 (a): PLM PDU HEATER LINES

PPDU ID Bd	L	T	TCS Heat.&Therm. IDENTIF. LABEL	Htr Line Power [W]	Equ. Res [Ω]	**Thermostat** Type & ID.n°	Threshold ON	OFF	Line Heaters Config. [Ω]	**Heater** Type & ID.n°	Shown on Figures Location	El. Scheme
7A	2	1	IBIS PEB1 (+Y)	15	47	TS-B8	-8	-2	47	HTR-H1	Fig. 7.1	7.6 (a)
						TS-B9	-8	-2				
7A	2	2	IBIS PEB2 (+Y)	15	47	TS-B10	-8	-2	47	HTR-H3	Fig. 7.1	7.7 (a)
						TS-B11	-8	-2				
7A	2	3	IBIS IEB1 (+Y) (*)	28.7	24.5	TS-B12	-8	-2	24.5	HTR-F1	Fig. 7.1	7.1 (a)
						TS-B13	-8	-2			(a) & (b)	
7A	2	4	JDPE1 (+Y)	11	63.8	TS-B14	-8	-2	64	HTR-C1	Fig. 7.1	7.8 (a)
						TS-B15	-8	-2				
7A	1	1	ODPE	8	88.	TS-B16	-8	-2	88	HTR-B1	Fig. 7.1	7.9 (a)
						TS-B17	-8	-2				
7A	1	2	IDPE1 (-Y)	4	176	TS-B18	-8	-2	176	HTR-E9	Fig. 7.1	7.10 (a)
						TS-B19	-8	-2				
7A	1	3	SDPE 2	4	176	TS-B20	-8	-2	176	HTR-E11	Fig. 7.1	7.11 (a)
						TS-B21	-8	-2				
7A	1	4	SPI CDE (+Y)	38	18.5	TS-B22	-8	-2	39//35	HTR-A1 (**),	Fig. 7.1	7.12 (a)
						TS-B23	-8	-2		HTR- D1		
7A	1	5	TCA Rad. (+Y)	21	33.3				3 times ..//(50*50)//	HTR-G5÷G10	Fig. 7.3 (a)	7.13 (a)

NOTE: (*) both main and redundant heater must be installed below the unit.
(**) Both main and redundant heater (type HTR-A) must be installed on the doubler over the upper unit. HTR-D1 heater will be installed as usual near the lower unit on the detector bench doubler.

Table 6.1 (b): PLM PDU HEATER LINES

PPDU ID			TCS Heat. & Therm.	Htr Line	Equ. Res	**Thermostat**	Threshold		Line Heaters	**Heater**	Shown on Figures	
Bd	L	T	IDENTIF. LABEL	Power [W]	[Ω]	Type & ID.n°	ON	OFF	Config. [Ω]	Type & ID.n°	Location	El. Scheme
4B	1	6	IBIS IEB2 (-Y) (*)	28.7	24.5	TS-A1	-23	-17	24.5	HTR-F4	Fig. 7.1	7.2 (b)
						TS-A2	-23	-17			(a) & (b)	
5B	1	6	IBIS CdTe (1)	48	14.6	TS-b1	-28	-22	42//42//47	HTR-a5, HTR –a6	Annex E	Annex E
			(for information only)			TS-b2	-28	-22		HTR –c1	Fig. E1-1	Fig. E2.1
5B	2	6	IBIS CsI	40	17.5	TS-b3	-28	-22	140//140//	HTR-d1, HTR-d2,	Annex E	Annex E
			(for information only)			TS-b4	-28	-22	140//140//	HTR-d3, HTR-d4,	Fig. E1-1	Fig. E2.2
									140//140//	HTR-d5, HTR-d6,		
									140//140	HTR-d7, HTR-d8		
6B	2	6	IBIS CdTe (2)	48	14.6	TS-b5	-28	-22	42//42//47	HTR-a7, HTR –a8	Annex E	Annex E
			(for information only)			TS-b6	-28	-22		HTR –c2	Fig. E1-1	Fig. E2.3
5B	1	5	IBIS Det. Unit	20.	35.	TS-C4	-3	+3	140//140//	HTRkk3,HTR – kk2	Annex E	Annex E
			(for information only)						140//140		Fig. E1-2	Fig. E2.4
6B	1	1	SPI I/F	16	44	TS-A3	-23	-17	176//176	HTR-E1,HTR-E3	Fig. 7.1	7.3 (b)
						TS-A24	-23	-17	//176//176	HTR-E5, HTR-E7		
6B	1	2	CALIBRATION	4	175	TS-d1	*-33*	*-27*	350//350	HTR-e3,HTR-e4	Annex E	Annex E
			UNIT (*for information only*)			TS-d2	*-33*	*-27*			Fig. E1-3	Fig. E2.5
6B	1	3	JDPE2 (-Y)	12	64	TS-A4	-23	-17	64	HTR-C4	Fig. 7.1	7.4 (b)
						TS-A5	-23	-17				
6B	1	4	IBIS VEB (*)	20	35.1	TS-A6	-23	-17	35.	HTR-D4	Fig. 7.1	7.5 (b)
						TS-A7	-23	-17			(a) & (b)	

NOTE: (*) both main and redundant heater must be installed below the unit.

Table 6.1 (c): PLM PDU REDUNDANT HEATER LINES

PPDU ID Bd	L	T	TCS Heat. & Therm. IDENTIF. LABEL	Htr Line Power [W]	Equ. Res [Ω]	**Thermostat** Type & ID.n°	Threshold ON	Threshold OFF	Line Heaters Config. [Ω]	**Heater** Type & ID.n°	Shown on Figures Location	Shown on Figures El. Scheme
7B	2	1	IBIS PEB1 (+Y)	15	47	TS-A8	-23	-17	47	HTR-H2	Fig. 7.1	7.6 (b)
						TS-A9	-23	-17				
7B	2	2	IBIS PEB2 (+Y)	15	47	TS-A10	-23	-17	47	HTR-H4	Fig. 7.1	7.7 (b)
						TS-A11	-23	-17				
7B	2	3	IBIS IEB1 (+Y) (*)	28.7	24.5	TS-A12	-23	-17	24.5	HTR-F2	Fig. 7.1 (a) & (b)	7.1 (b)
						TS-A13	-23	-17				
7B	2	4	JDPE1 (+Y)	11	63.8	TS-A14	-23	-17	64	HTR-C2	Fig. 7.1	7.8 (b)
						TS-A15	-23	-17				
7B	1	1	ODPE	8	88	TS-A16	-23	-17	88	HTR-B2	Fig. 7.1	7.9 (b)
						TS-A17	-23	-17				
7B	1	2	IDPE1 (-Y)	4	176	TS-A18	-23	-17	176	HTR-E10	Fig. 7.1	7.10 (b)
						TS-A19	-23	-17				
7B	1	3	SDPE 2	4	176	TS-A20	-23	-17	176	HTR-E12	Fig. 7.1	7.11 (b)
						TS-A21	-23	-17				
7B	1	4	SPI CDE (+Y)	38	18.5	TS-A22	-23	-17	39//35	HTR-A2 (**), HTR-D2	Fig. 7.1	7.12 (b)
						TS-A23	-23	-17				
7B	1	5	TCA Rad. (-Y)	21	33.3				3 times ..//(50*50)//..	HTR-G15÷ G20	Fig. 7.3 (b)	7.13 (b)

NOTE: (*) both main and redundant heater must be installed below the unit
(**) both main and redundant heater (type HTR-A) must be installed on the doubler over the upper unit. HTR-D2 heater will be installed as usual near the lower unit on the detector bench doubler.

Table 6.1 (d): PLM PDU REDUNDANT HEATER LINES

6.2 SVM PDU HEATER LINES

The SVM PDU heater lines are hereafter described:

SPDU ID.			TCS Heat. & Therm.	Htr Line	Equ. Res	**Thermostat**	Treshold		Line Heaters	**Heater**	Shown on Figures	
Bd	L	T	IDENTIF. LABEL	Power [W]	[Ω]	Type & ID.n°	ON	OFF	Config. [Ω]	Type & ID.n°	Location	El. Scheme
5A	2	1	TANK 2	4.3	163.	TS-Q1	20	26	350//	HTR-N1,	Fig. 7.4	7.14 (a)
						TS-Q2	20	26	610//610	HTR-P1, P2		
5A	2	2	TANK 4	8.6	81.5	TS-Q3	20	26	350//350//610//	HTR-N2,N3,P3	Fig. 7.5	7.15 (a)
						TS-Q4	20	26	610//610//610	HTR-P4,P5,P6		
5A	2	3	TANK 3	4.3	163.	TS-Q5	20	26	350//	HTR-N4,	Fig. 7.6	7.16 (a)
						TS-Q6	20	26	610//610	HTR-P7,P8		
5A	2	4	TANK 1	8.6	81.5	TS-Q7	20	26	350//350//610//	HTR-N5/N6/P9	Fig. 7.7	7.17 (a)
						TS-Q8	20	26	610//610//610	HTR-P10, P11,12		
5A	2	5	Batteries NCB-1	21	33.4	TS-S1/S2 TS-R1/R2	-5 -10	1 0	(134//134) //	HTR-J1, HTR-J2,	Fig. 7.8	7.18 (a)
			NCB-2			TS-S3/S4 TS-R3/R4	-5 -10	1 0	//(134//134)	HTR-J3, HTR-J4		
5A	1	1	RCS PIPING (LV,	23.	30.5	TS-F9÷F32	25	31		See		
			LF & PT included)							CHAPTER 8		
5A	1	5	SAS +Y	2.0	346.6	TS-H1	-30	-20	520 // (520*520)	HTR-L1,	Fig. 7.9	7.19 (a)
						TS-D1	0	6		HTR-L2 (#)		
5A	1	6	SAS -Y &	5.0	140.4	TS-H3	-30	-20	520 // (520*520)	HTR-L3, L4 (#)	Figg.	7.20 (a)
						TS-D2	0	6			7.10 (a)	
			SAS +Z			TS-H2/H4	-30	-20	//(470//470)	HTR- I1, I2	7.10 (b)	

NOTE: (#) the two separate circuits of this heater are connected in series

Table 6.2 (a): SVM PDU HEATER LINES

SPDU ID. Bd	L	T	TCS Heat. & Therm. IDENTIF. LABEL	Htr Line Power [W]	Equ. Res [Ω]	**Thermostat** Type & ID.n°	Threshold ON	Threshold OFF	Line Heaters Config. [Ω]	**Heater** Type & ID.n°	Shown on Figures Location	Shown on Figures El. Scheme
6A	2	6	TCS FCV 2 (+Z)	4	175	TS-F1,F5	25	31	350//350	HTR-Q1, HTR-Q2	Fig. 7.11	7.21 (a)
						TS-F2,F6	25	31				
			TCS FCV 1 (-Z)	4	175	TS-T1,T5	22	42	350//350	HTR-Q3, HTR-Q4	Fig. 7.12	7.22 (a)
						TS-T2,T6	22	42				
			TCS FCV 3 (+Z)	4	175	TS-F3,F7	25	31	350//350	HTR-Q5, HTR-Q6	Fig. 7.13	7.23 (a)
						TS-F4,F8	25	31				
			TCS FCV 4 (-Z)	4	175	TS-T3,T7	22	42	350//350	HTR-Q7, HTR-Q8	Fig. 7.14	7.24 (a)
						TS-T4,T8	22	42				
6A	1	2	STRH 1	7.4	95	TS-L1	-10	-4	95	HTR-M1	Fig. 7.15	7.25 (a)
						TS-L2	-10	-4				
6A	1	3	STRH 2	7.4	95	TS-L3	-10	-4	95	HTR-M2	Fig. 7.16	7.26 (a)
						TS-L4	-10	-4				
6A	1	4	IMUE 1 & 2,	12	58.7	TS-N1, N2	5	15	350 //350	HTR-X1, X2	Fig. 7.17	7.27 (a)
			IMUH			TS-F33, F34	25	31	350//176//350	HTR-X3,E13,X4		
6A	1	5	RWL	40.	17.5	TS-N3÷N10	5	15	4 times	HTR-	Fig. 7.18	7.28 (a)
									(140//140)	K1/2/3/4		

Table 6.2 (b): SVM PDU HEATER LINES

SPDU ID.			TCS Heat. & Therm.	Htr Line	Equ. Res	**Thermostat**	Treshold		Line Heaters	**Heater**	Shown on Figures	
Bd	L	T	IDENTIF. LABEL	Power [W]	[Ω]	Type & ID.n°	ON	OFF	Config. [Ω]	Type & ID.n°	Location	El. Scheme
5B	2	1	TANK 2 (+Z)	4.3	163.	TS-P1	11	17	350//	HTR-N7	Fig. 7.4	7.14 (b)
						TS-P2	11	17	610//610	HTR-P13/ P14		
5B	2	2	TANK 4 (-Z)	8.6	81.5	TS-P3	11	17	350//350//610//	HTR-N8/9/P15	Fig. 7.5	7.15 (b)
						TS-P4	11	17	610//610//610	HTR-P16/17/18		
5B	2	3	TANK 3 (+Z)	4.3	163.	TS-P5	11	17	350//	HTR-N10	Fig. 7.6	7.16 (b)
						TS-P6	11	17	610//610	HTR-P19/20		
5B	2	4	TANK 1 (-Z)	8.6	81.5	TS-P7	11	17	350//350//610//	HTR-N11/12/P21	Fig. 7.7	7.17 (b)
						TS-P8	11	17	610//610//610	HTR-P22/23/24		
5B	2	5	Batteries NCB-1	21	33.4	TS-S5/S6	-5	1	(134//134)//	HTR-J5, HTR-J6,	Fig. 7.8	7.18 (b)
						TS-R5/R6	-10	0				
			NCB-2			TS-S7/S8	-5	1	//(134//134)	HTR-J7, HTR-J8		
						TS-R7/R8	-10	0				
5B	1	1	RCS PIPING (LV,	23.	30.5	TS-Q9÷32	20	26		See		
			LF & PT included)							CHAPTER 8		
5B	1	5	SAS +Y	2.0	346.6	TS-G1	-35	-25	520 // (520*520)	HTR-L5,	Fig. 7.9	7.19 (b)
						TS-C1	-3	+3		HTR-L6 (#)		
5B	1	6	SAS -Y &	5.0	140.4	TS-G3	-35	-25	520 // (520*520)	HTR-L7, L8 (#)	Figg.	7.20 (b)
						TS-C2	-3	+3			7.10 (a)	
			SAS +Z			TS-G2/G4	-35	-25	//(470//470)	HTR- I3, I4	7.10 (b)	

NOTE: (#) the two separate circuits of each heater are connected in series

Table 6.2 (c): SVM PDU REDUNDANT HEATER LINES

SPDU ID. Bd	L	T	TCS Heat. & Therm. IDENTIF. LABEL	Htr Line Power [W]	Equ. Res [Ω]	**Thermostat** Type & ID.n°	Treshold ON	Treshold OFF	Line Heaters Config. [Ω]	**Heater** Type & ID.n°	Shown on Figures Location	Shown on Figures El. Scheme
6B	2	6	TCS FCV 2 (+Z)	4	175	TS-E1,E5	17	23	350//350	HTR-Q9, HTR-Q10	Fig. 7.11	7.21 (b)
						TS-E2,E6	17	23				
			TCS FCV 1 (-Z)	4	175	TS-U1,U5	17	37	350//350	HTR-Q11, HTR-Q12	Fig. 7.12	7.22 (b)
						TS-U2,U6	17	37				
			TCS FCV 3 (+Z)	4	175	TS-E3,E7	17	23	350//350	HTR-Q13, HTR-Q14	Fig. 7.13	7.23 (b)
						TS-E4,E8	17	23				
			TCS FCV 4 (-Z)	4	175	TS-U3,U7	17	37	350//350	HTR-Q15, HTR-Q16	Fig. 7.14	7.24 (b)
						TS-U4,U8	17	37				
6B	1	2	STRH 1	7.4	95	TS-A25	-23	-17	95	HTR-M3	Fig. 7.15	7.25 (b)
						TS-A26	-23	-17				
6B	1	3	STRH 2	7.4	95	TS-A27	-23	-17	95	HTR-M4	Fig. 7.16	7.26 (b)
						TS-A28	-23	-17				
6B	1	4	IMUE 1 & 2,	12	58.7	TS-M1, M2	0	10	350 //350	HTR-X5, X6	Fig. 7.17	7.27 (b)
			IMUH			TS-N11, N12	5	15	350//176//350	HTR-X7,E14,X8		
6B	1	5	RWL	40.	17.5	TS-M3÷M10	0	10	4 times	HTR-	Fig. 7.18	7.28 (b)
									(140//140)	K5/6/7/8		

Table 6.2 (d): SVM PDU REDUNDANT HEATER LINES

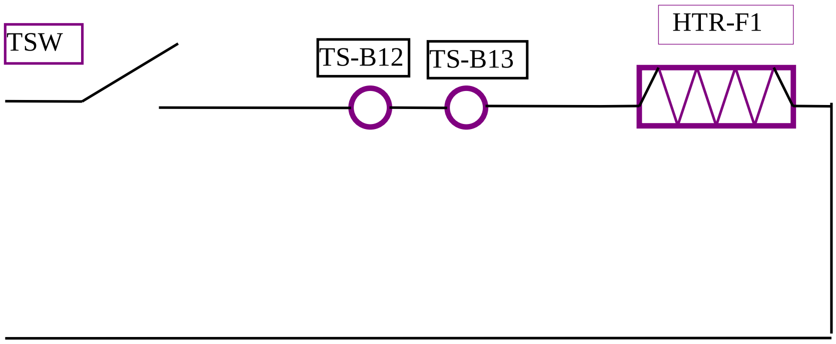
7. HEATERS AND THERMOSTATS LINES ELECTRICAL SCHEMES

In this paragraph the schemes of each electrical line configuration, including all the heaters and thermostats, are shown.

TCS IBIS IEB1 (+Y) Heater

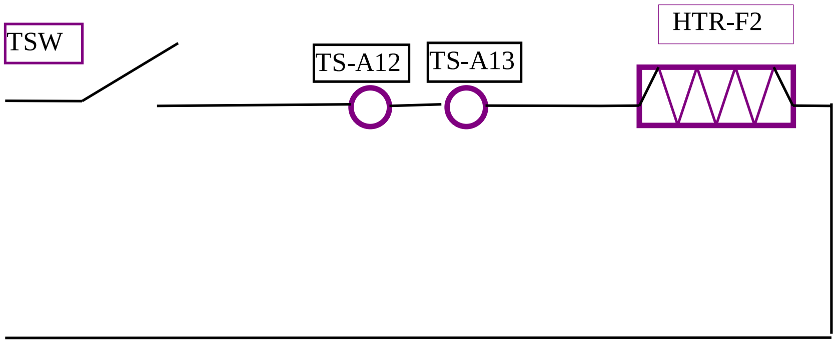
- Type: Substitution
- Installed Thermal Power: 28.7 W

PDU LCL =7A.2.3 IBIS IEB1 = 28.7 W



Scheme 7.1(a): IBIS IEB1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.2.3 IBIS IEB1 = 28.7 W

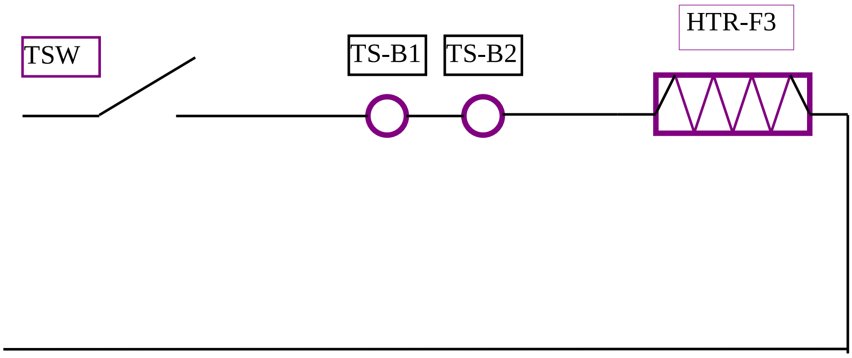


Scheme 7.1(b): IBIS IEB1 CONFIGURATION (REDUNDANT CIRCUIT)

TCS IBIS IEB2 (-Y) Heater

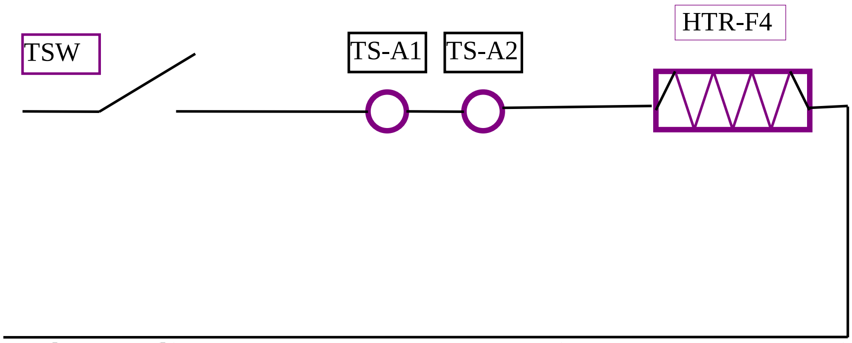
- Type: Substitution
- Installed Thermal Power: 28.7 W

PDU LCL = 4A.1.6 IBIS IEB2 = 28.7 W



Scheme 7.2(a): IBIS IEB2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 4B.1.6 IBIS IEB2 = 28.7 W

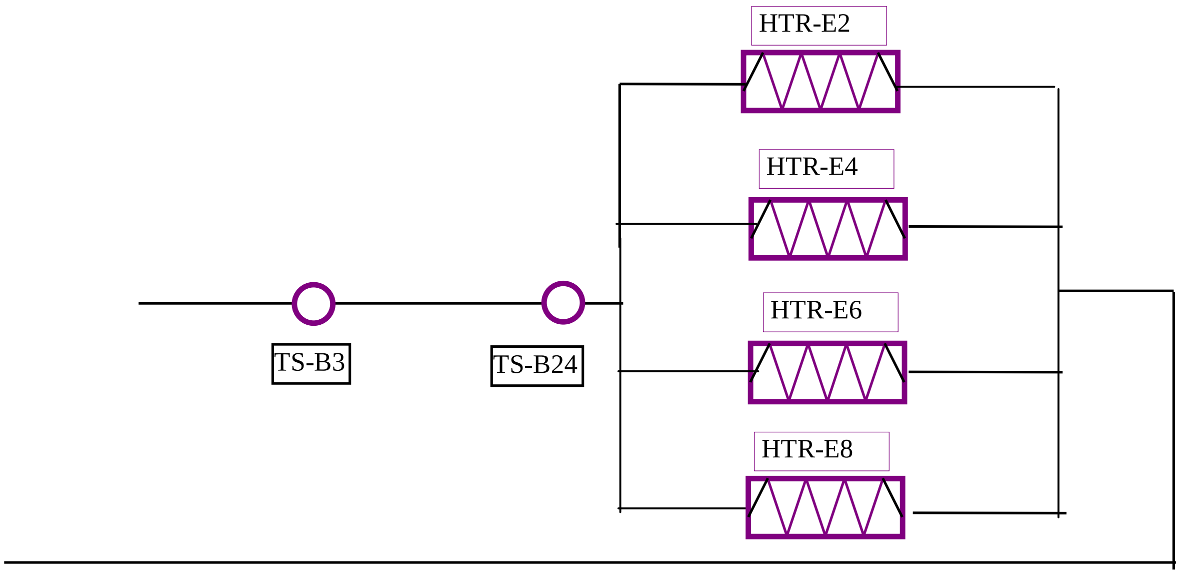


Scheme 7.2(b): IBIS IEB2 CONFIGURATION (REDUNDANT CIRCUIT)

TCS SPI I/F Heater

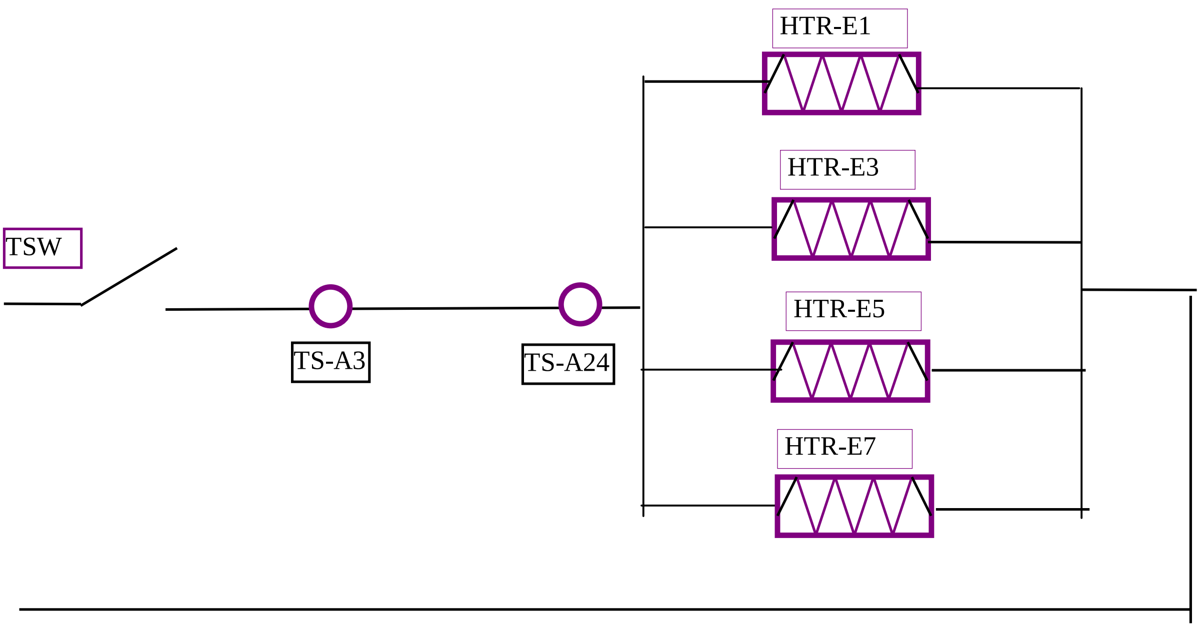
- Type: Compensation-Substitution
- Installed Thermal Power: 16 W

PDU LCL = 6A.1.1 SPI I/F = 4W + 4W + 4W + 4W



Scheme 7.3(a): SPI I/F CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 6B.1.1 SPI I/F = 4W + 4W + 4W + 4W

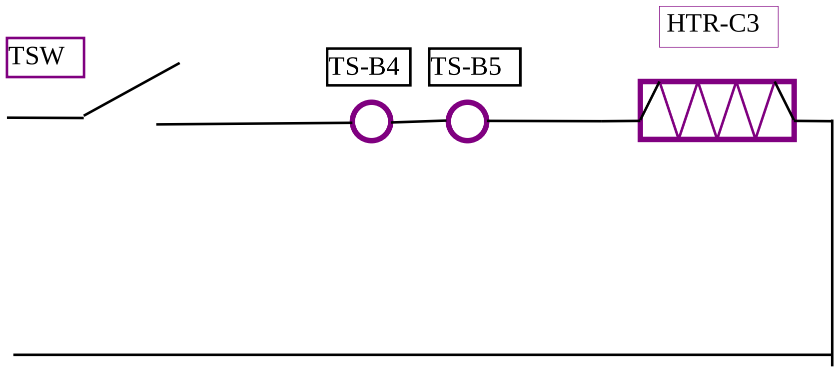


Scheme 7.3(b): SPI I/F CONFIGURATION (REDUNDANT CIRCUIT)

TCS JDPE2 (-Y) Heater

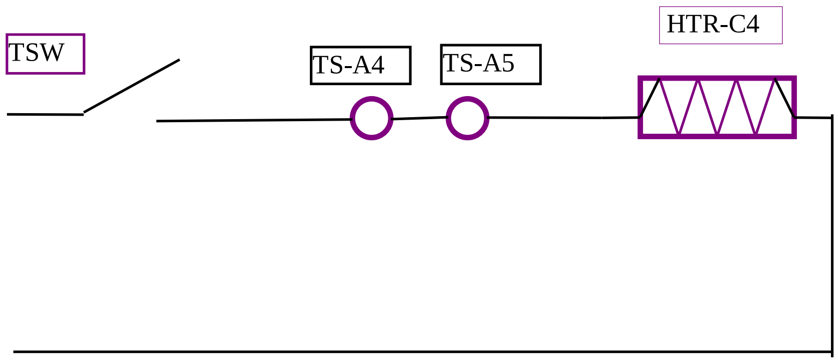
- Type: Substitution
- Installed Thermal Power: 11 W

PDU LCL =6A.1.3 JEMX DPE2 = 11 W



Scheme 7.4(a): JEM-X DPE2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.1.3 JEMX DPE2 = 11 W

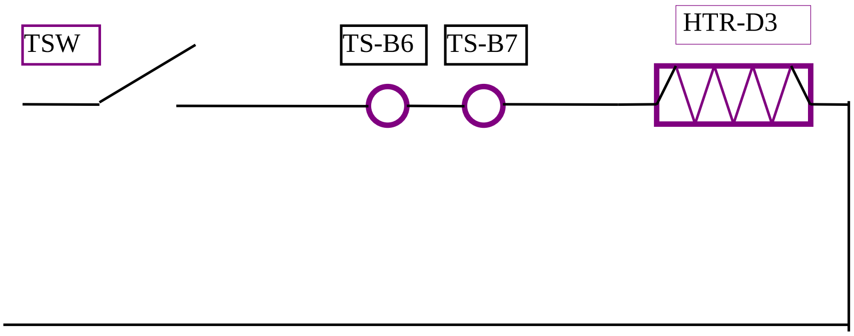


Scheme 7.4(b): JEM-X DPE2 CONFIGURATION (REDUNDANT CIRCUIT)

TCS IBIS VEB Heater

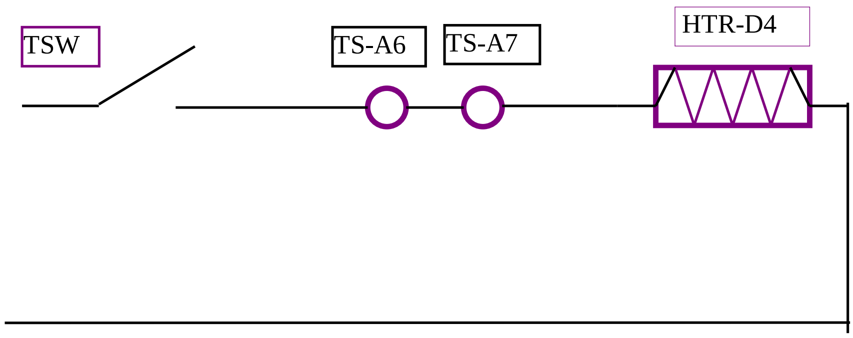
- Type: Substitution
- Installed Thermal Power: 20 W

PDU LCL =6A.1.4 IBIS VEB = 20.W



Scheme 7.5(a): IBIS VEB CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.1.4 IBIS VEB = 20.W

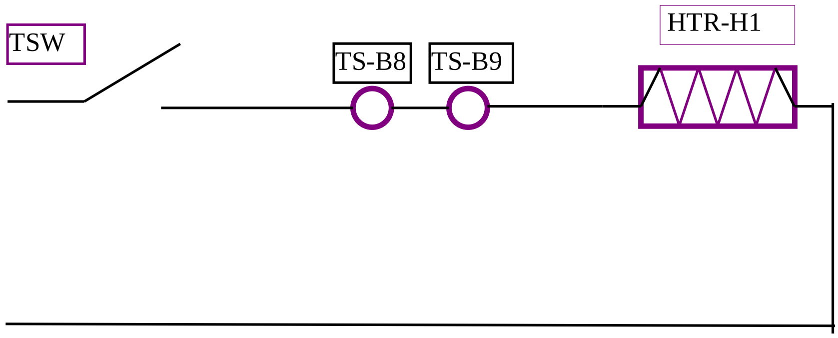


Scheme 7.5(b): IBIS VEB CONFIGURATION (REDUNDANT CIRCUIT)

TCS IBIS PEB1 (+Y) and PEB2 (+Y) Heaters

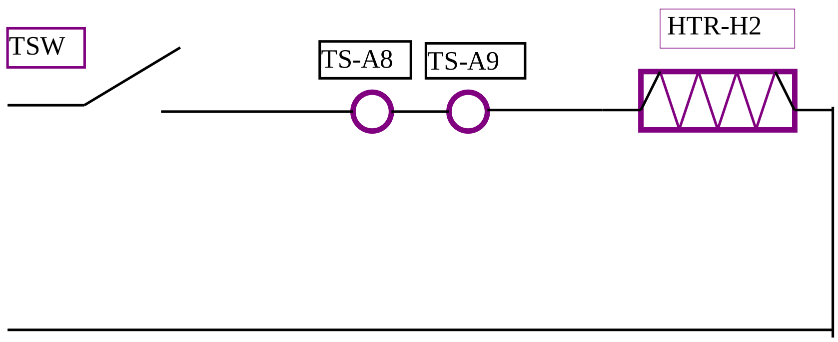
- Type: Substitution
- Installed Thermal Power: 15 W

PDU LCL =7A.2.1 IBIS PEB1 = 15W



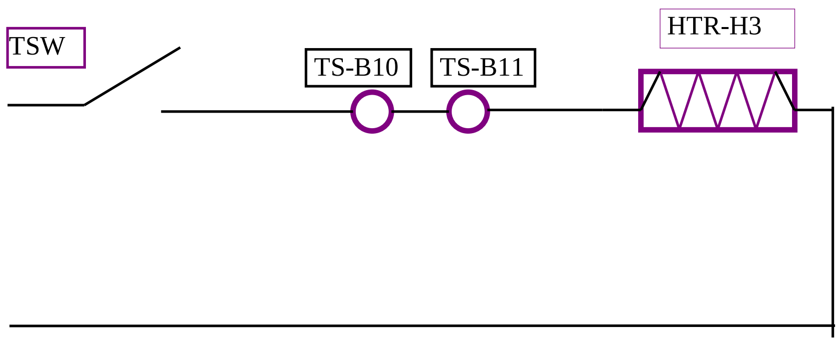
Scheme 7.6(a): IBIS PEB1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.2.1 IBIS PEB1 = 15W



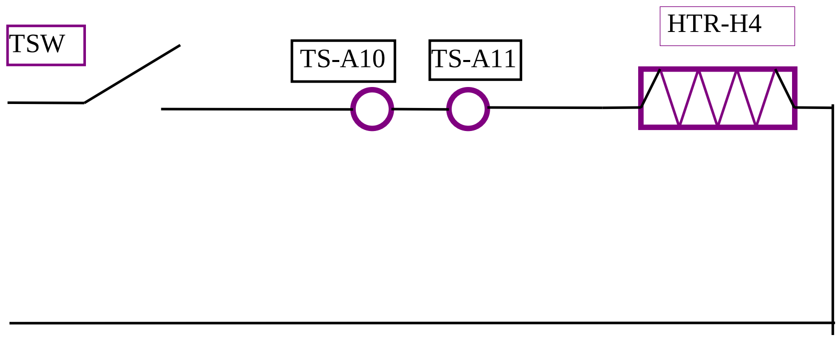
Scheme 7.6(b): IBIS PEB1 CONFIGURATION (REDUNDANT CIRCUIT)

PDU LCL =7A.2.2 IBIS PEB2 = 15 W



Scheme 7.7(a): IBIS PEB2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.2.2 IBIS PEB2 = 15 W

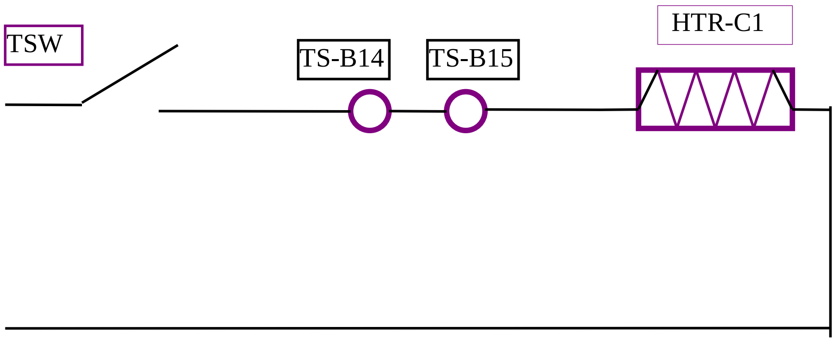


Scheme 7.7(b): IBIS PEB2 CONFIGURATION (REDUNDANT CIRCUIT)

TCS JDPE1 (+Y) Heater

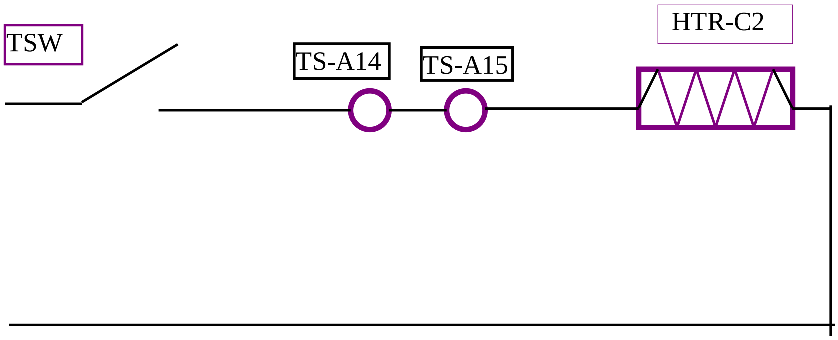
- Type: Substitution
- Installed Thermal Power: 11 W

PDU LCL =7A.2.4 JDPE1 = 11 W



Scheme 7.8(a): IBIS JEM-X DPE1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.2.4 JDPE1 = 11 W

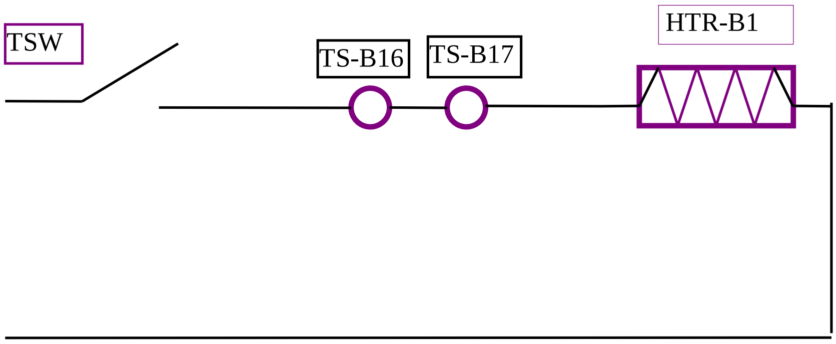


Scheme 7.8(b): IBIS JEM-X DPE1 CONFIGURATION (REDUNDANT CIRCUIT)

TCS ODPE (+Y) Heater

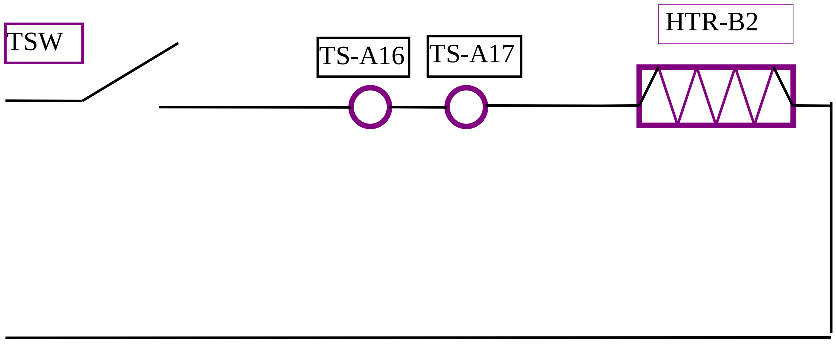
- Type: Substitution
- Installed Thermal Power: 8 W

PDU LCL =7A.1.1 ODPE = 8 W



Scheme 7.9(a): ODPE CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.1.1 ODPE = 8 W

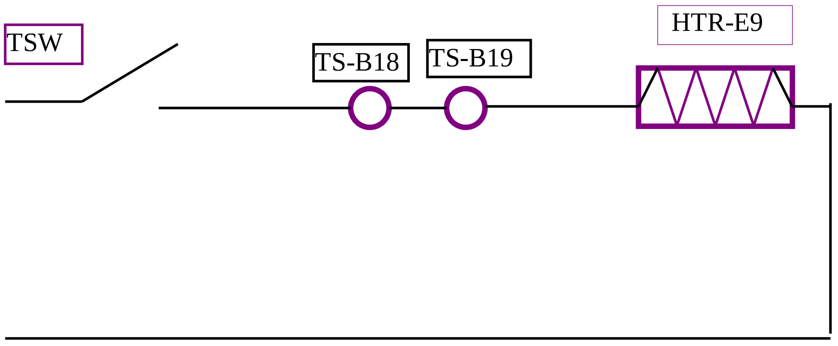


Scheme 7.9(b): ODPE CONFIGURATION (REDUNDANT CIRCUIT)

TCS IDPE1 (-Y) Heater

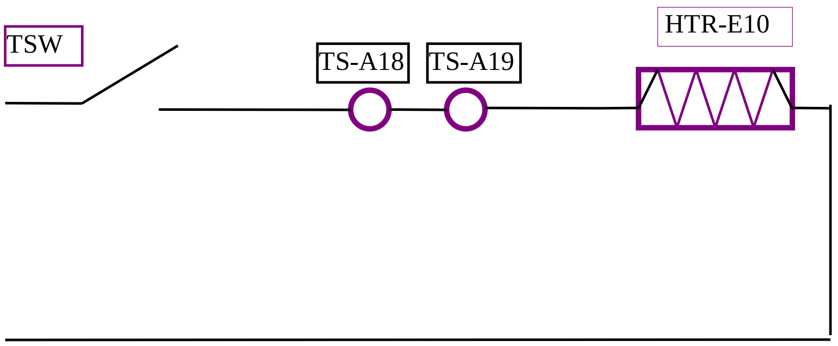
- Type: Substitution
- Installed Thermal Power: 4 W

PDU LCL =7A.1.2 IBIS DPE1 = 4 W



Scheme 7.10(a): IBIS DPE1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.1.2 IBIS DPE1 = 4 W

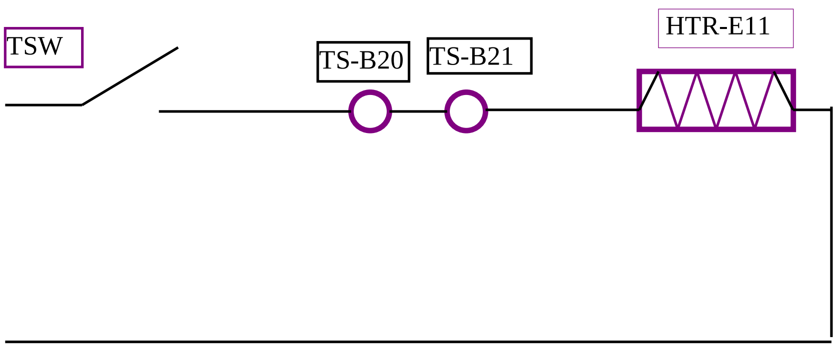


Scheme 7.10(b): IBIS DPE1 CONFIGURATION (REDUNDANT CIRCUIT)

TCS SDPE2 (-Y) Heater

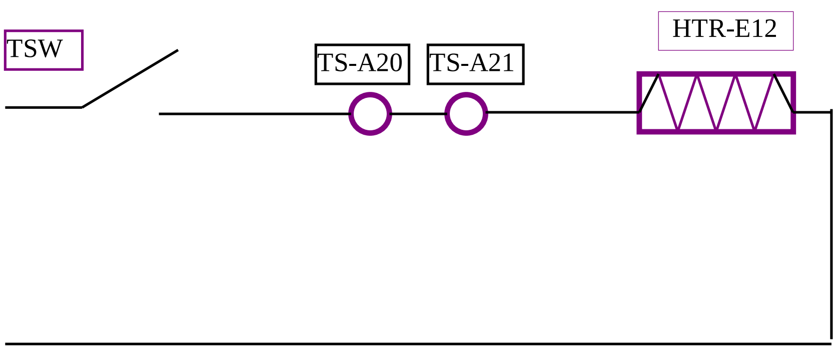
- Type: Substitution
- Installed Thermal Power: 4 W

PDU LCL =7A.1.3 SDPE2 = 4 W



Scheme 7.11(a): SPI DPE2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.1.3 SDPE2 = 4 W

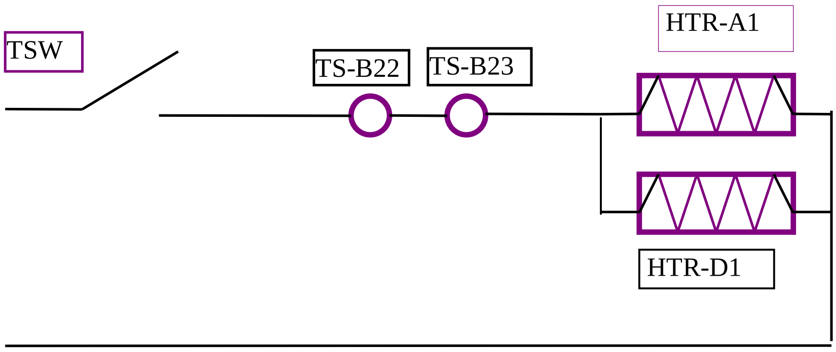


Scheme 7.11(b): SPI DPE2 CONFIGURATION (REDUNDANT CIRCUIT)

TCS SPI CDE Heaters

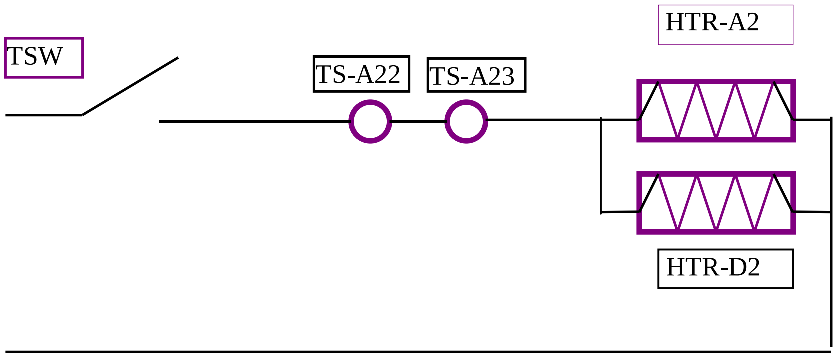
- Type: Substitution
- Installed Thermal Power: 38 W

PDU LCL =7A.1.4 CDE = 18 W + 20 W



Scheme 7.12(a): SPI CDE CONFIGURATION (MAIN CIRCUIT)

PDU LCL =7B.1.4 CDE = 18 W + 20 W

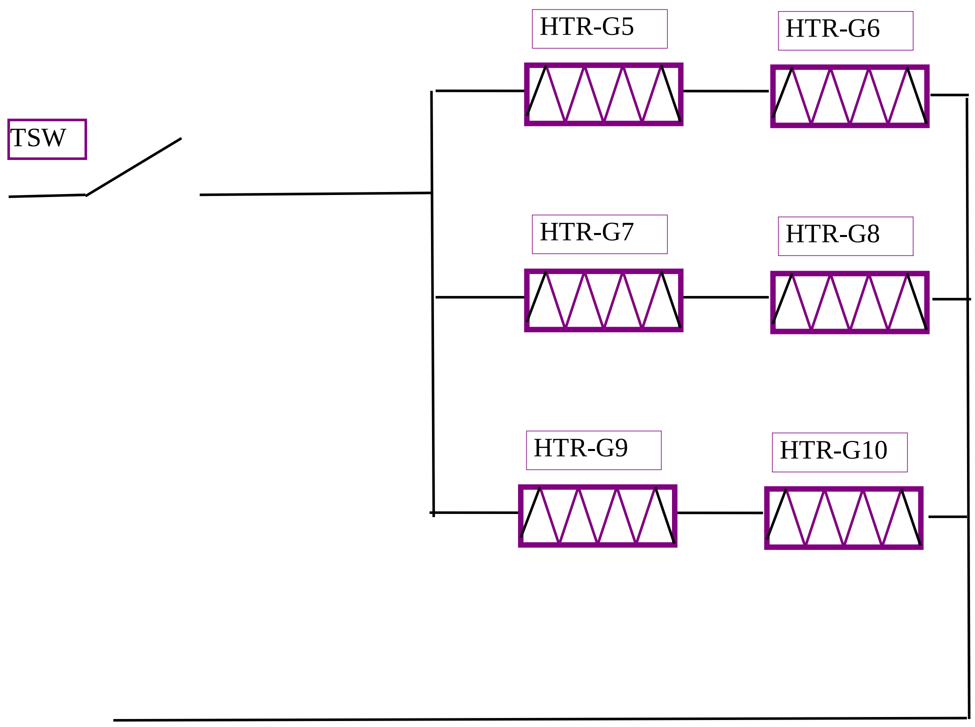


Scheme 7.12(b): SPI CDE CONFIGURATION (REDUNDANT CIRCUIT)

TCS IBIS TCA + Y RADIATOR Heaters

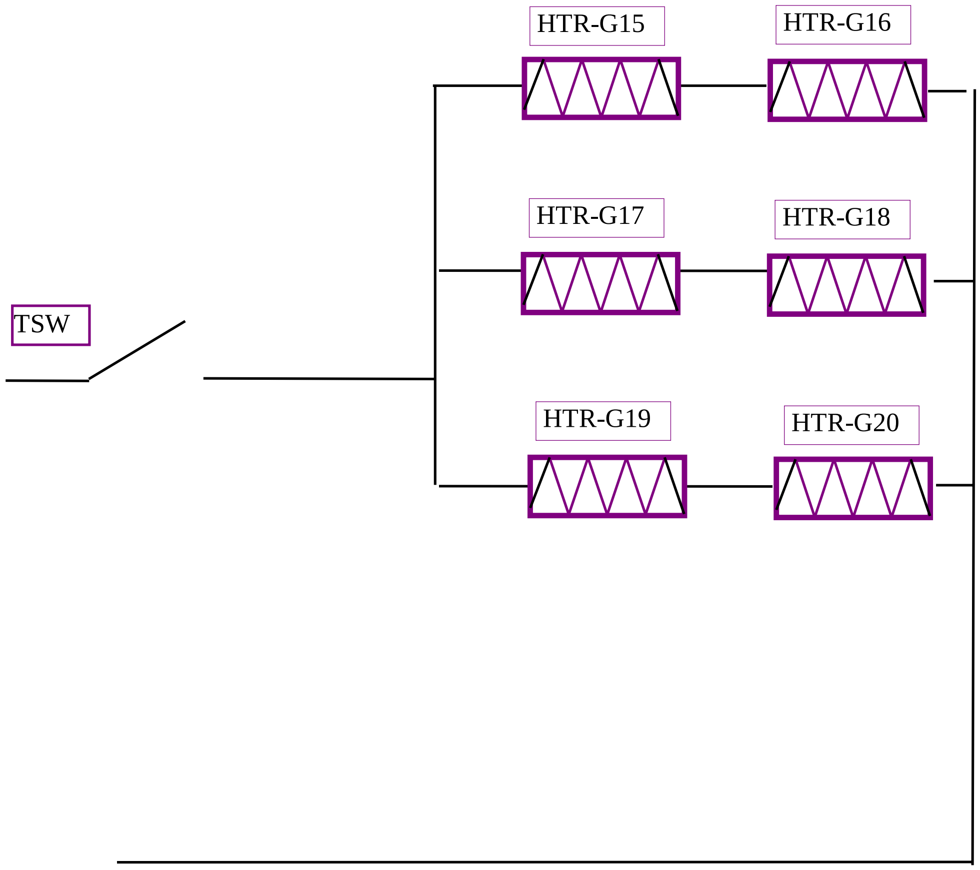
- Installed Thermal Power: 21 W

PDU LCL =7A.1.5 IBIS TCA + Y RADIATOR = 3 x (3.5W + 3.5W) =21.W



Scheme 7.13(a): IBIS TCA + Y RADIATOR CONFIGURATION (MAIN CIRCUIT)

***Sc* PDU LCL =7B.1.5 IBIS TCA - Y RADIATOR = 3 x (3.5W + 3.5W) =21.W**



heme 7.13(b): IBIS TCA – Y RADIATOR CONFIGURATION (REDUNDANT CIRCUIT)

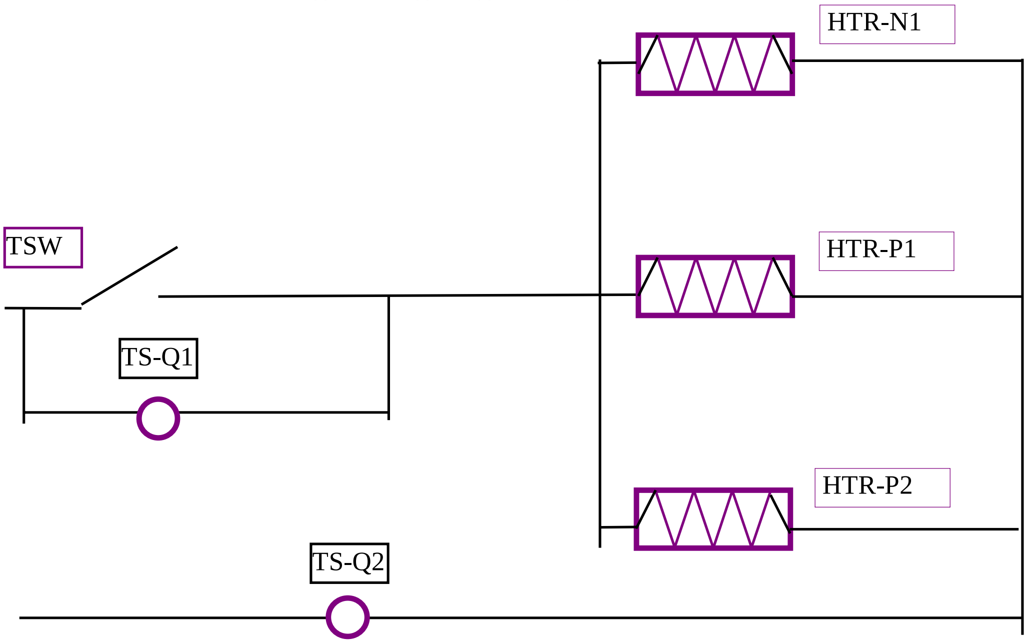
7.1 SVM-PDU Thermal Loops Electrical Configuration

In this paragraph the electrical configurations of all P-PDU thermal control loops are reported.

Tank 2 (+Z) Heaters

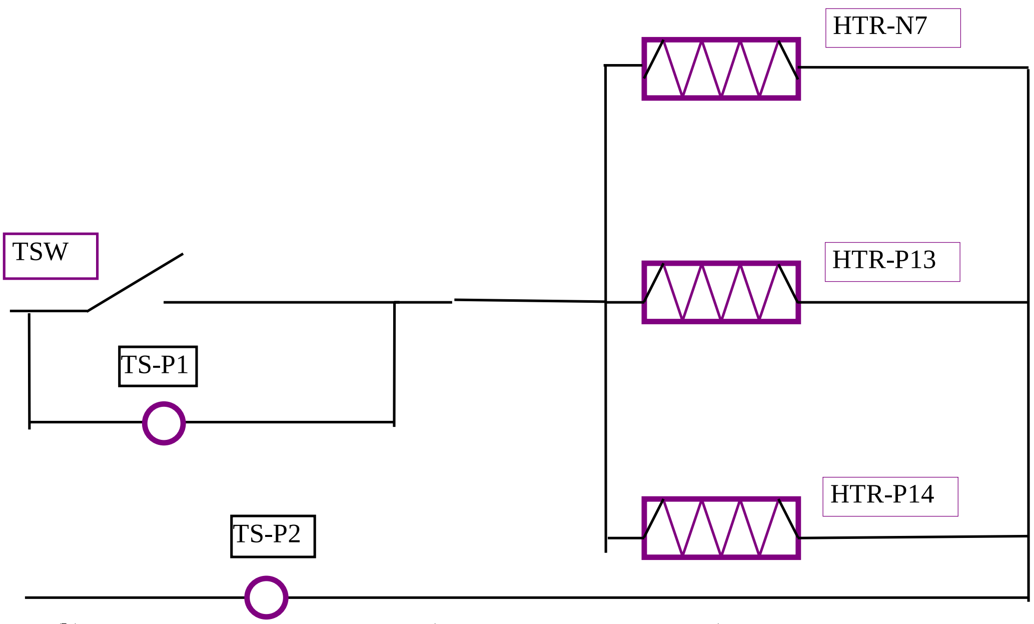
- Installed Thermal Power: 4.3 W

PDU LCL =5A.2.1 TANK 2 = 1.15 W +1.15 W +2W = 4.3W



Scheme 7.14(a): TANK 2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =5B.2.1 TANK 2 = 1.15 W +1.15 W +2W = 4.3W

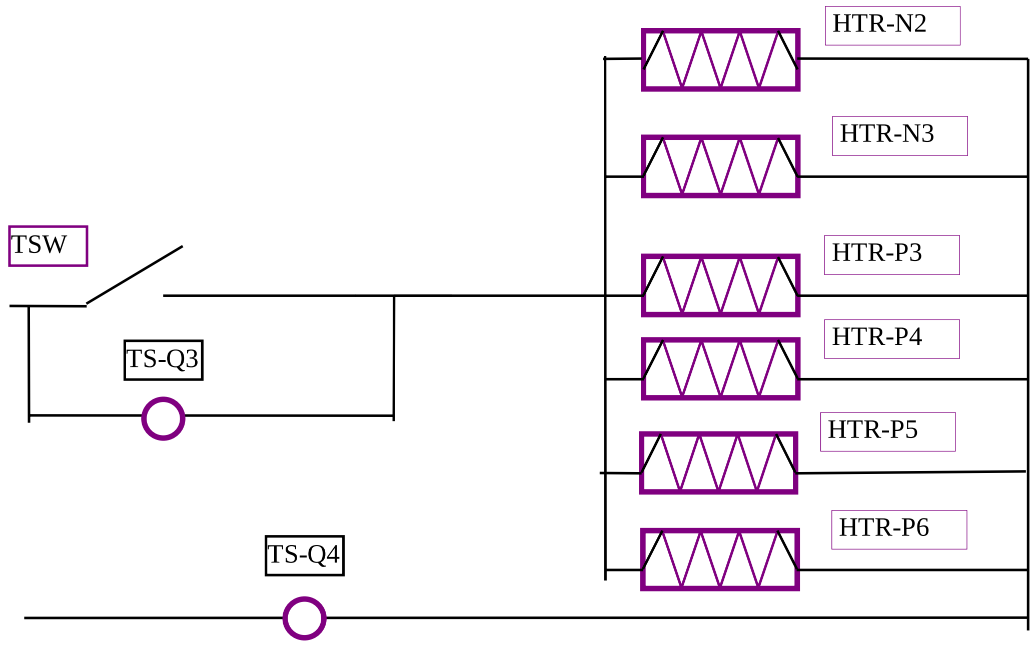


Scheme 7.14(b): TANK 2 CONFIGURATION (REDUNDANT CIRCUIT)

Tank 4 (-Z) Heaters

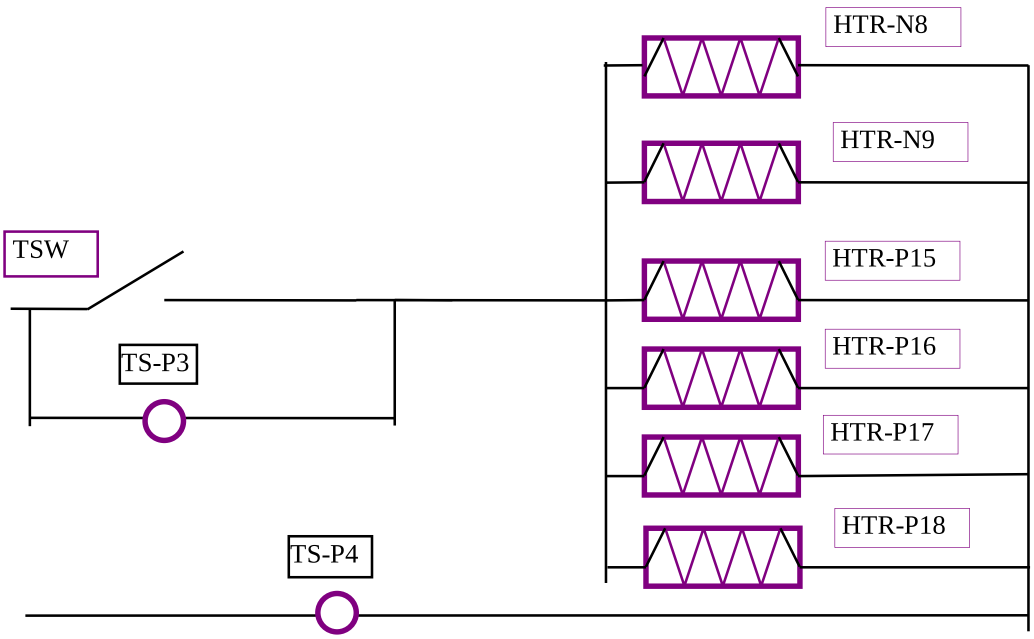
- Installed Thermal Power: 8.6 W

PDU LCL =5A.2.2 TANK 4 = 1.15 W +1.15 W +1.15 W +1.15 W + 2 W +2W = 8.6W



Scheme 7.15 (a): TANK 4 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =5B.2.2 TANK 4 = 1.15 W +1.15 W +1.15 W +1.15 W + 2 W +2W = 8.6W

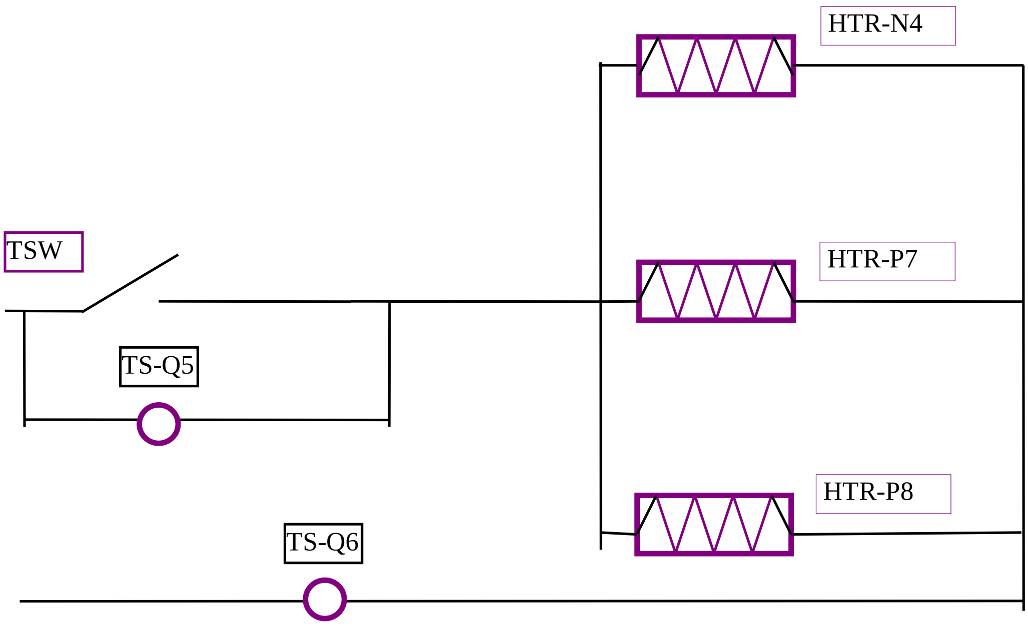


Scheme 7.15 (b): TANK 4 CONFIGURATION (REDUNDANT CIRCUIT)

Tank 3 (+Z) Heaters

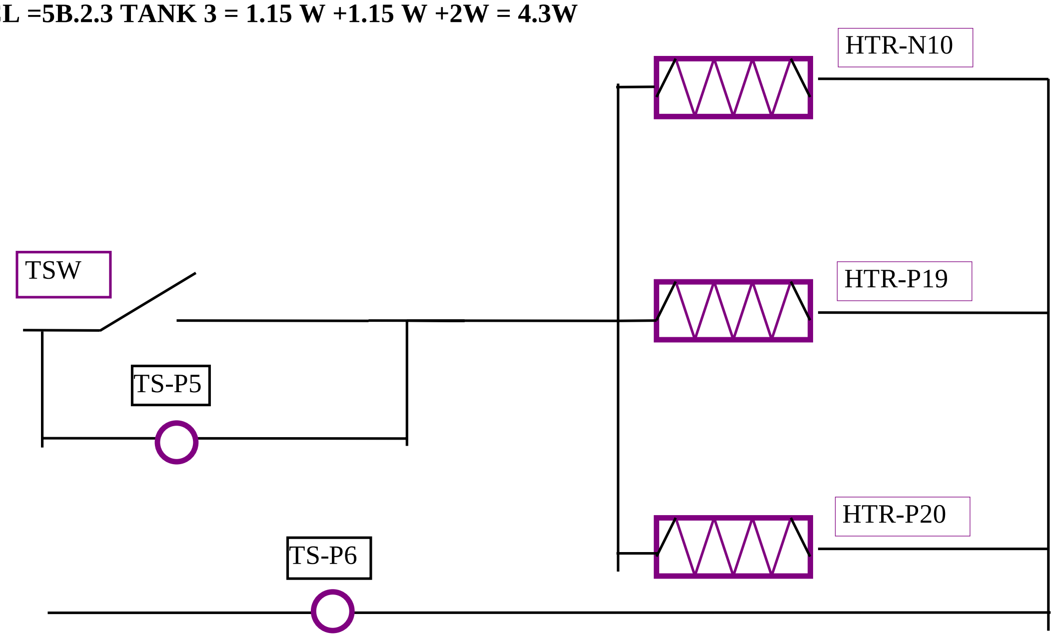
- Installed Thermal Power: 4.3 W

PDU LCL =5A.2.3 TANK 3 = 1.15 W +1.15 W +2W = 4.3W



Scheme 7.16 (a): TANK 3 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =5B.2.3 TANK 3 = 1.15 W +1.15 W +2W = 4.3W

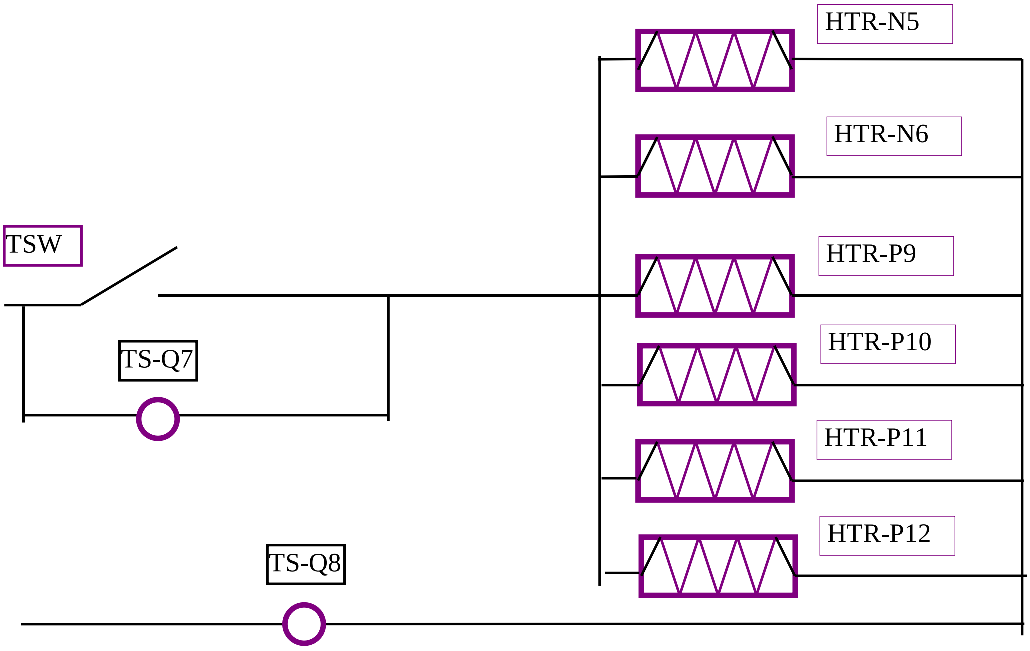


Scheme 7.16 (b): TANK 3 CONFIGURATION (REDUNDANT CIRCUIT)

Tank 1 Heaters

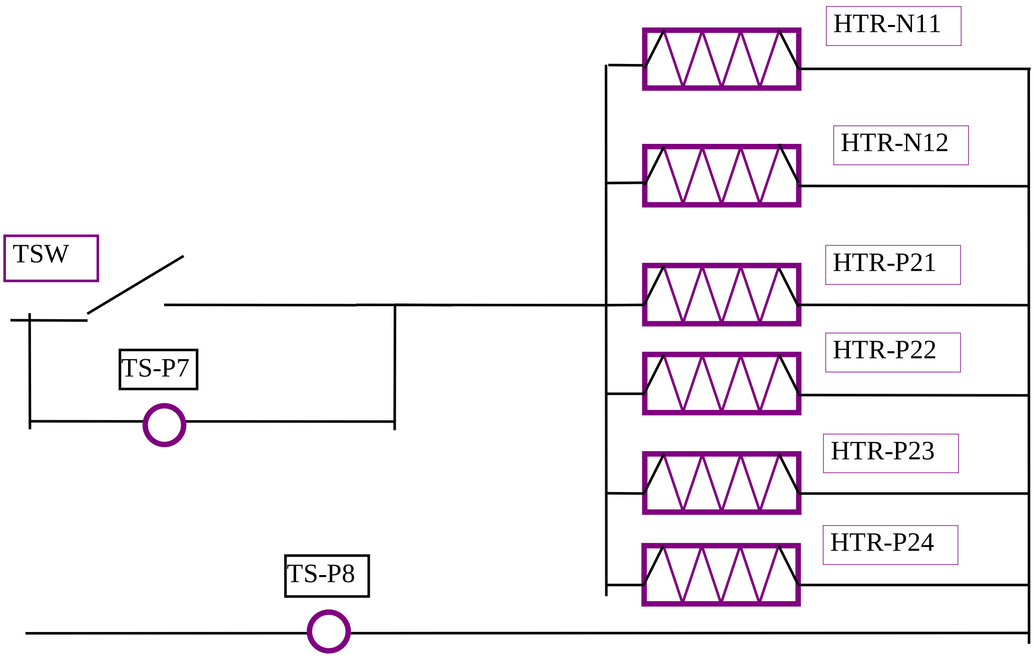
- Installed Thermal Power: 8.6 W

PDU LCL = 5A.2.4 TANK 1 = 1.15 W +1.15 W +1.15 W +1.15 W + 2 W +2W = 8.6W



Scheme 7.17(a): TANK 1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 5B.2.4 TANK 1 = 1.15 W +1.15 W +1.15 W +1.15 W + 2 W +2W = 8.6W

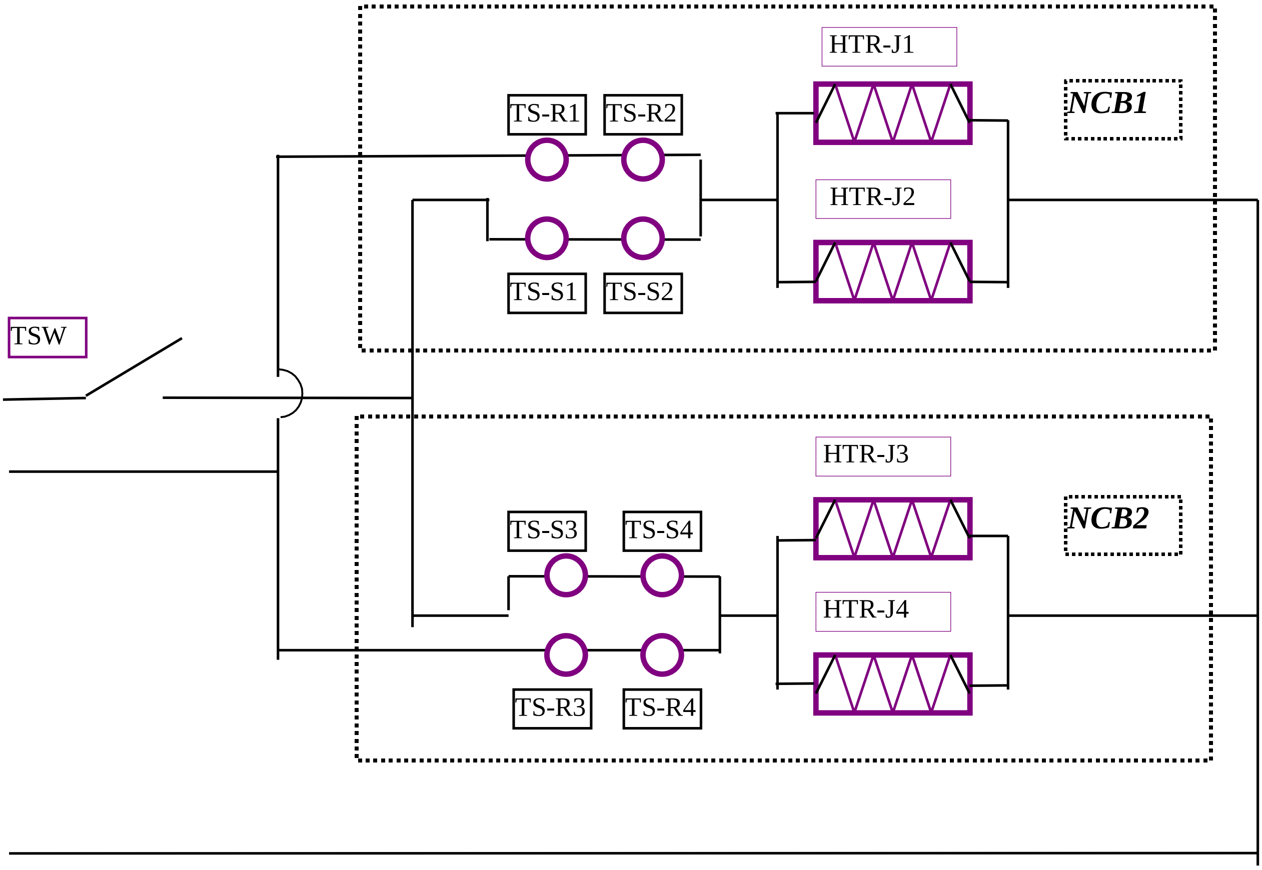


Scheme 7.17(b): TANK 1 CONFIGURATION (REDUNDANT CIRCUIT)

Batteries Heaters (for information only)

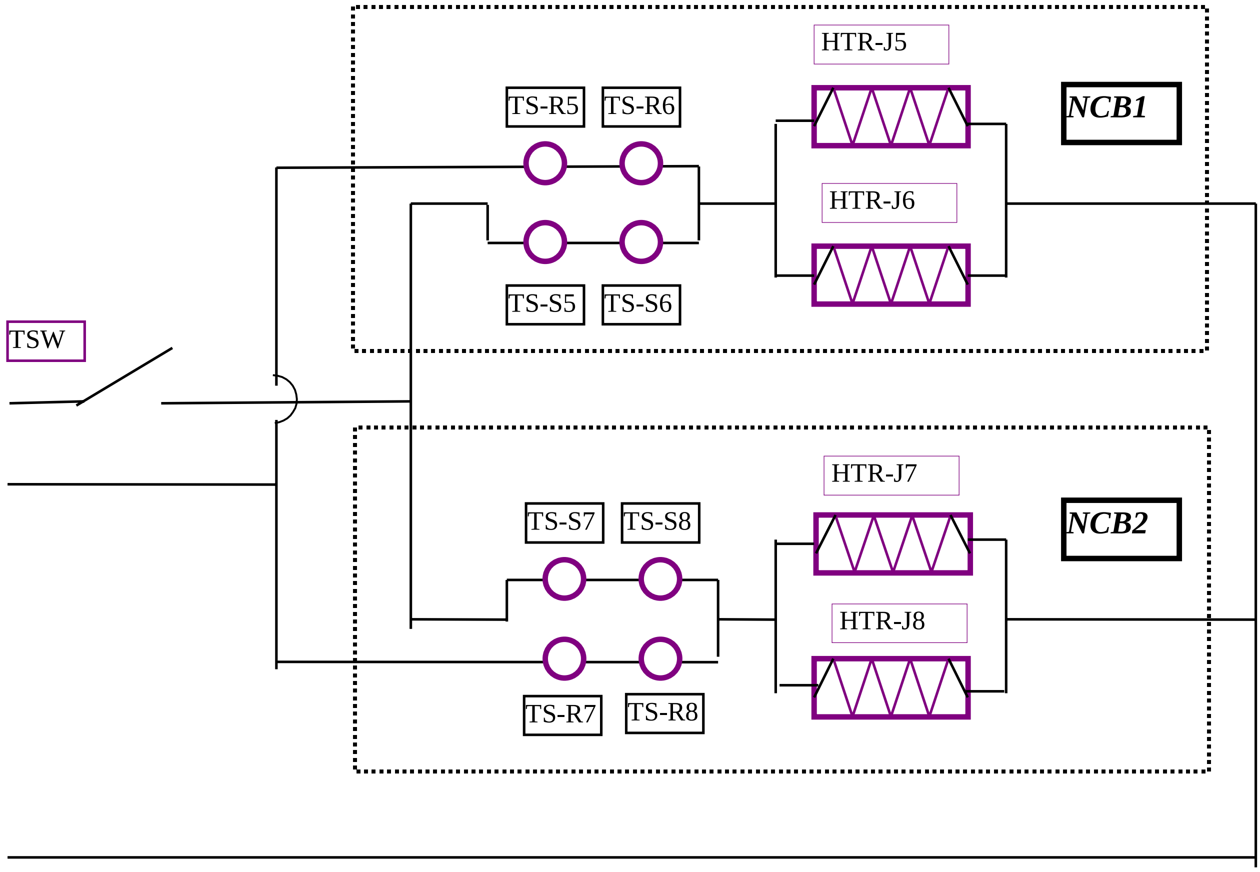
- Installed Thermal Power: 10.5 W for each battery

PDU LCL = 5A.2.5 Batteries = (5.25W + 5.25 W) + (5.25W + 5.25 W)



Scheme 7.18 (a): NCB 1 & 2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =5B.2.5 Batteries = (5.25W + 5.25 W) + (5.25W + 5.25 W)

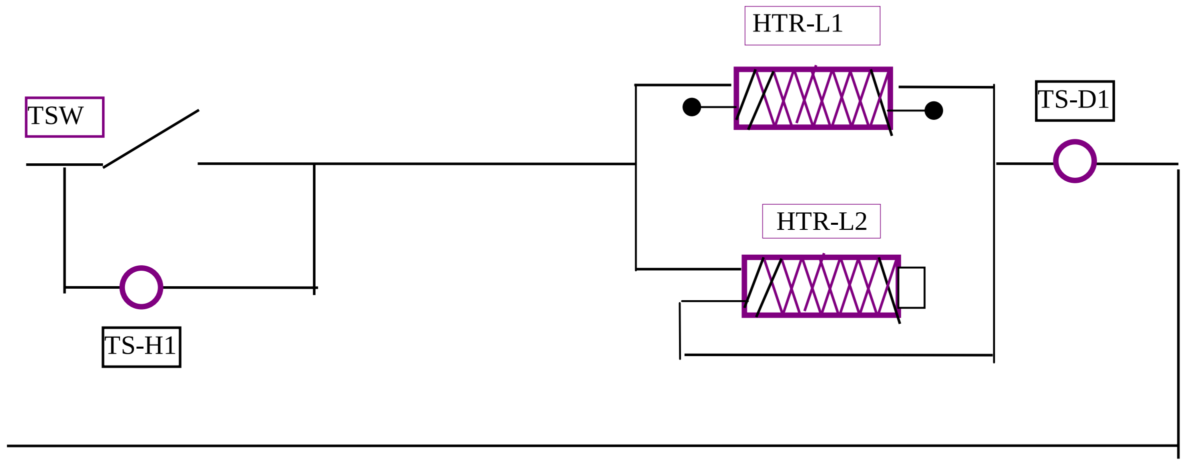


Scheme 7.18 (b): NCB 1 & 2 CONFIGURATION (REDUNDANT CIRCUIT)

SAS +Y Heaters

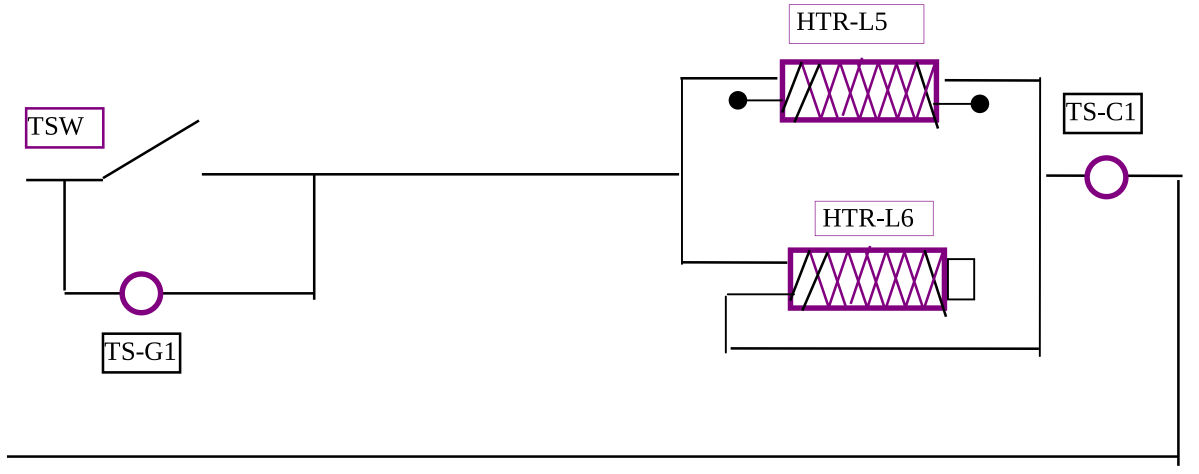
- Installed Thermal Power: 2.0 W

PDU LCL = 5A.1.5 SAS +Y = 1.35W + 0.34W + 0.34W



Scheme 7.19 (a): SAS +Y CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 5B.1.5 SAS +Y = 1.35W + 0.34W + 0.34W



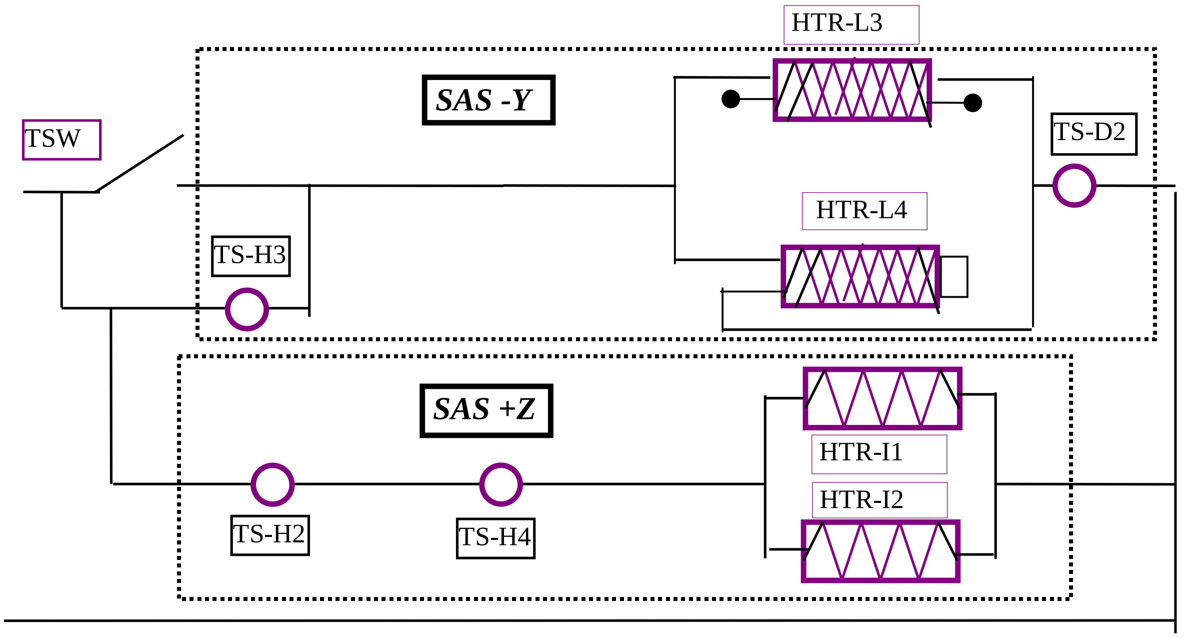
Scheme 7.19 (b): SAS +Y CONFIGURATION (REDUNDANT CIRCUIT)

NOTE: each heater type L has 2 internal circuits; in one heater the two internal circuits are connected in series.

SAS –Y & +Z Heaters

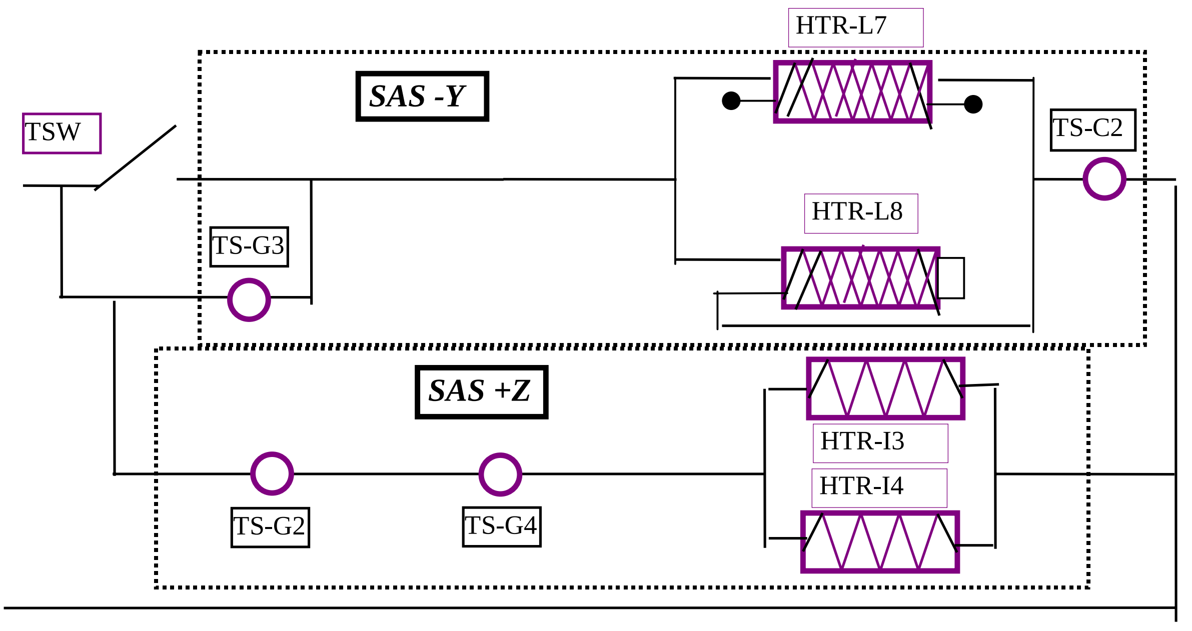
- Installed Thermal Power: 5.0 W

PDU LCL = 5A.1.6 SAS –Y & +Z = 1.35W + 0.34W + 0.34W +1.5W +1.5W



Scheme 7.20 (a): SAS -Y & +Z CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 5B.1.6 SAS - Y & +Z = 1.35W + 0.34W + 0.34W +1.5W +1.5W



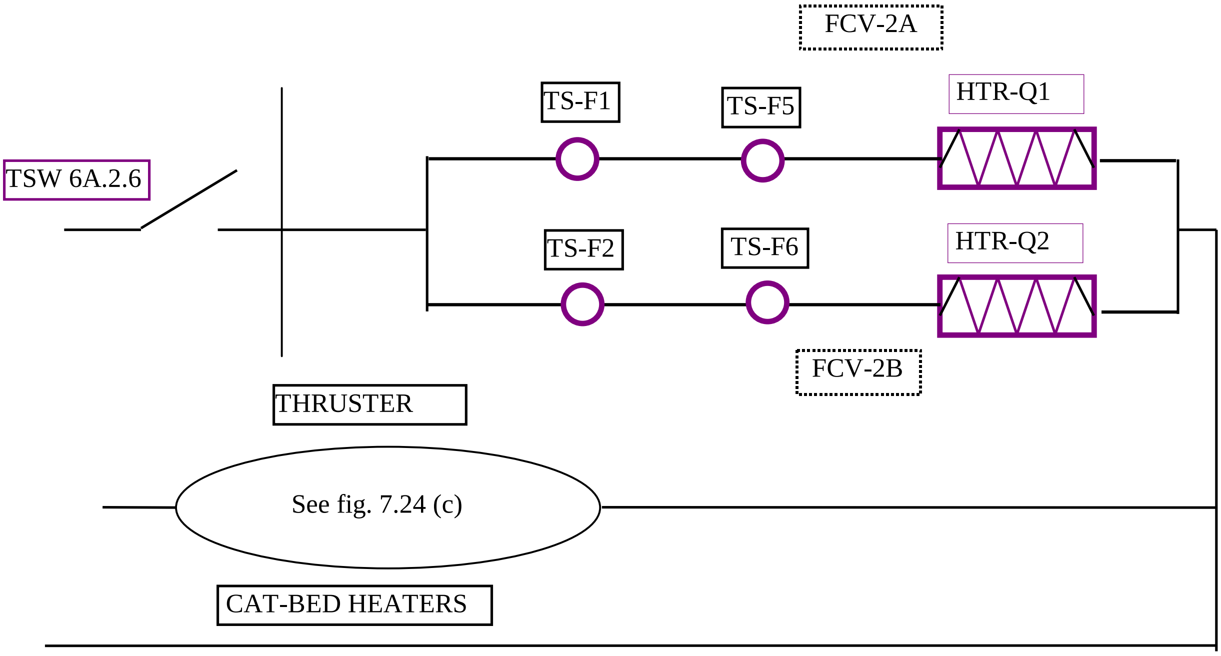
Scheme 7.20 (b): SAS - Y & +Z CONFIGURATION (REDUNDANT CIRCUIT)

NOTE: each heater type L has 2 internal circuits; in one heater the two internal circuits are connected in series.

Thruster FCV 2 (+Z)

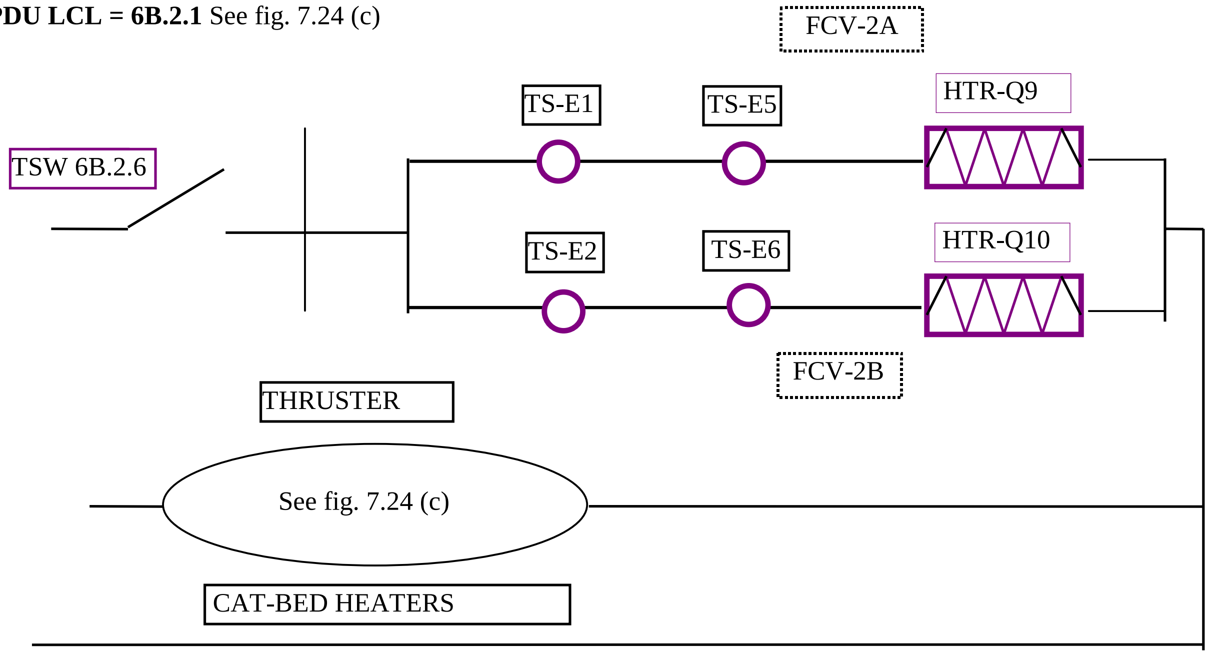
- Installed Thermal Power: 4.W

PDU LCL = 6A.2.6 FCV 2 = 2.W + 2.W
PDU LCL = 6A.2.1 See fig. 7.24 (c)



Scheme 7.21 (a): FCV 2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 6B.2.6 FCV 2 = 2.W + 2.W
PDU LCL = 6B.2.1 See fig. 7.24 (c)

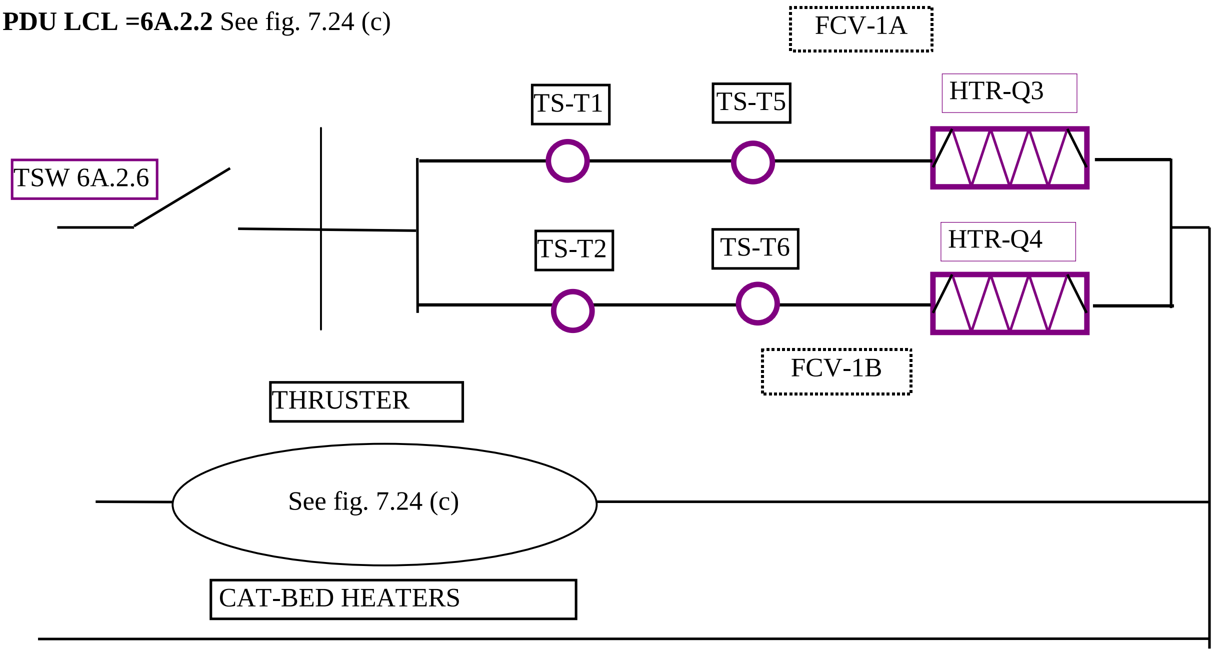


Scheme 7.21 (b): FCV 2 CONFIGURATION (REDUNDANT CIRCUIT)

Thruster FCV 1 (-Z)

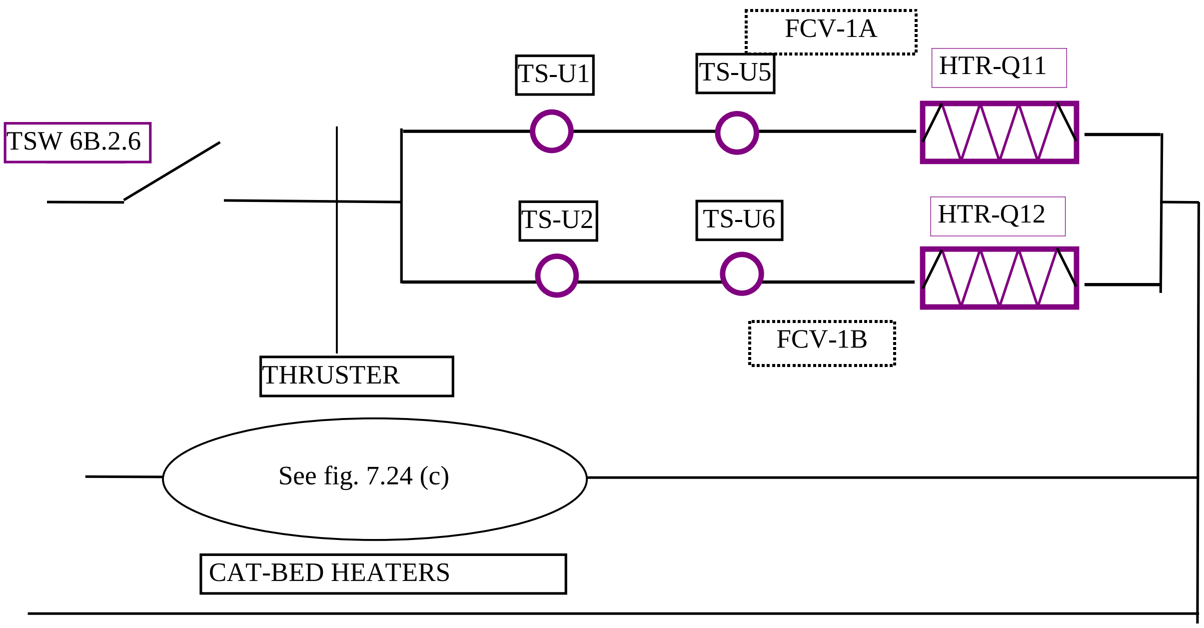
- Installed Thermal Power: 4.W

PDU LCL =6A.2.6 FCV 1 = 2.W + 2.W
PDU LCL =6A.2.2 See fig. 7.24 (c)



Scheme 7.22 (a): FCV 1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.2.6 FCV 1 = 2.W + 2.W
PDU LCL =6B.2.2 See fig. 7.24 (c)

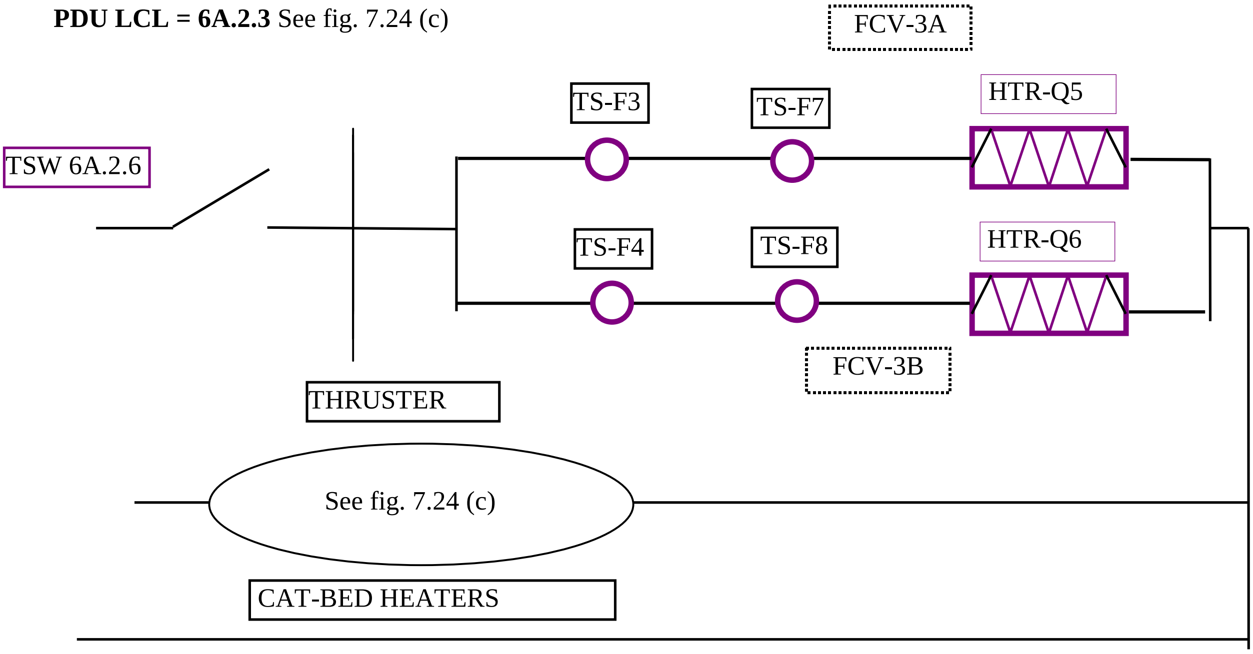


Scheme 7.22 (b): FCV 1 CONFIGURATION (REDUNDANT CIRCUIT)

Thruster FCV 3 (+Z)

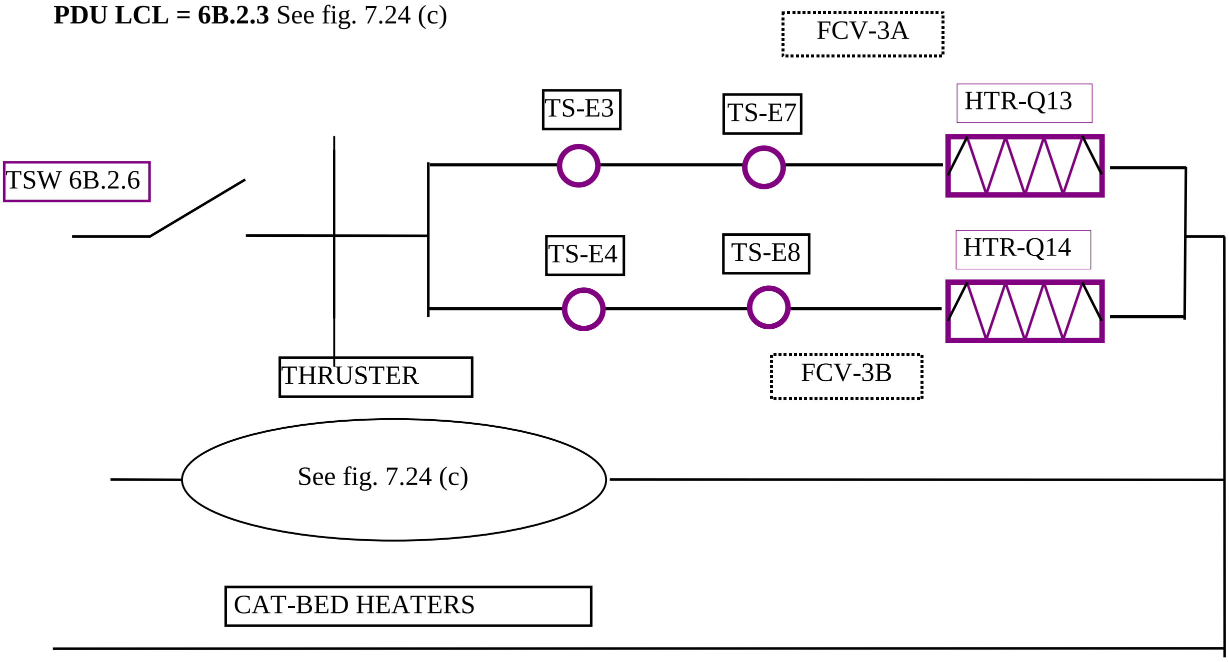
- Installed Thermal Power: 4.W

PDU LCL = 6A.2.6 FCV 3 = 2.W + 2.W
PDU LCL = 6A.2.3 See fig. 7.24 (c)



Scheme 7.23 (a): FCV 3 CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 6B.2.6 FCV 3 = 2.W + 2.W
PDU LCL = 6B.2.3 See fig. 7.24 (c)

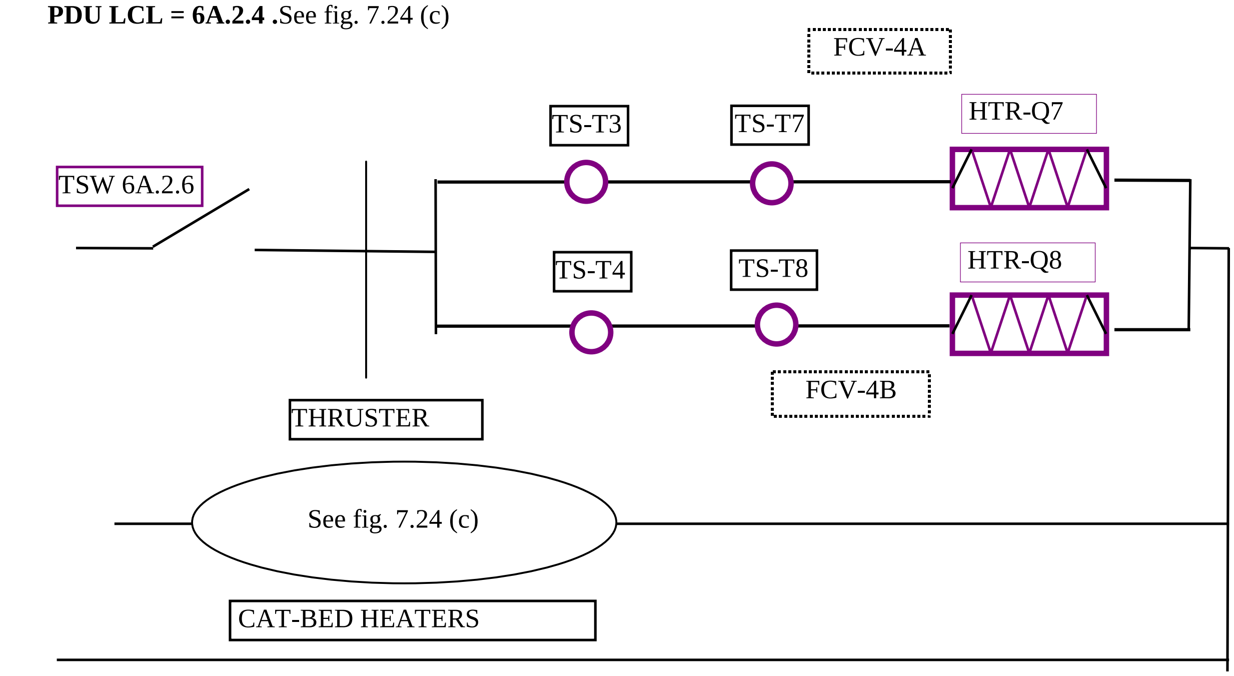


Scheme 7.23 (b): FCV 3 CONFIGURATION (REDUNDANT CIRCUIT)

Thruster FCV 4 (-Z)

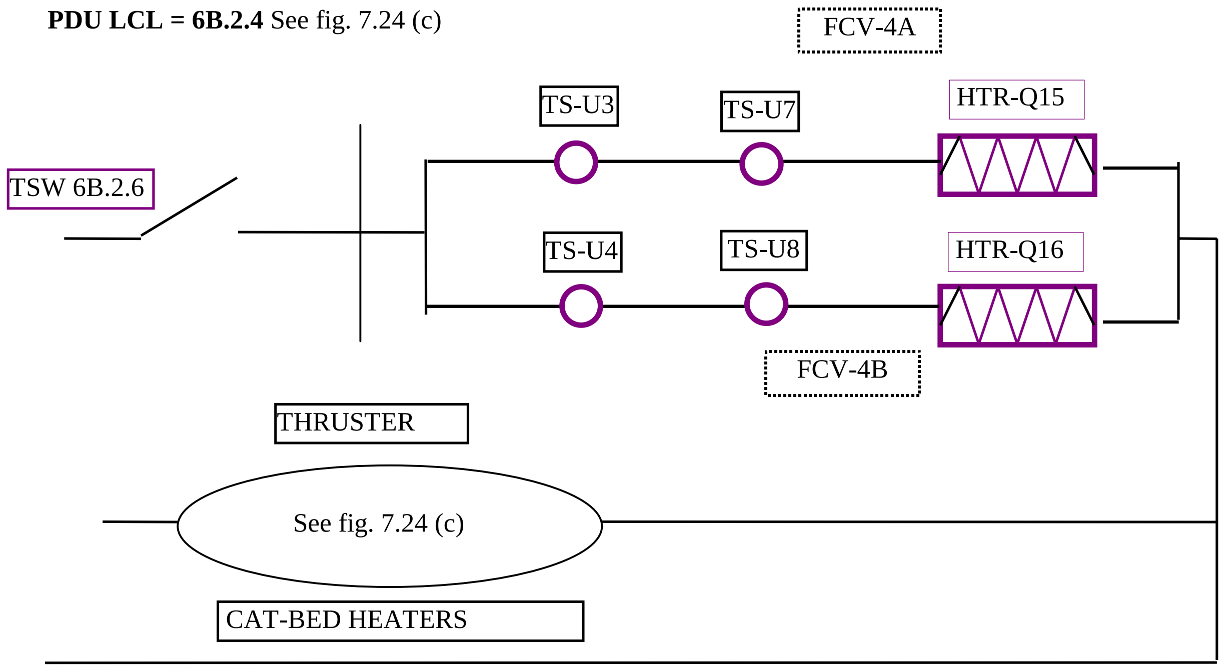
- Installed Thermal Power: 4.W

PDU LCL = 6A.2.6 FCV 4 = 2.W + 2.W
PDU LCL = 6A.2.4 . See fig. 7.24 (c)

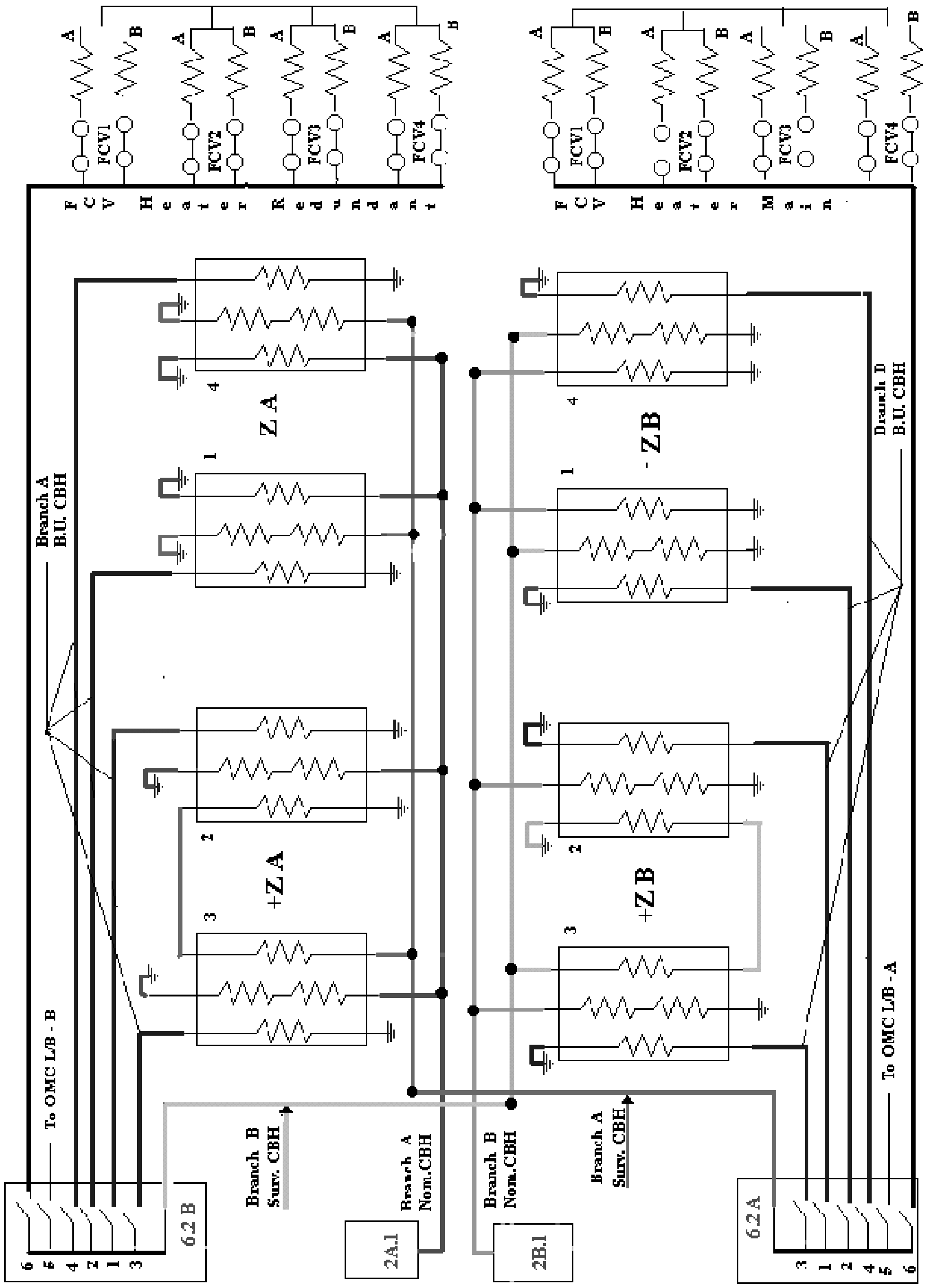


Scheme 7.24 (a): FCV 4 CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 6B.2.6 FCV 4 = 2.W + 2.W
PDU LCL = 6B.2.4 See fig. 7.24 (c)



Scheme 7.24 (b): FCV 4 CONFIGURATION (REDUNDANT CIRCUIT)

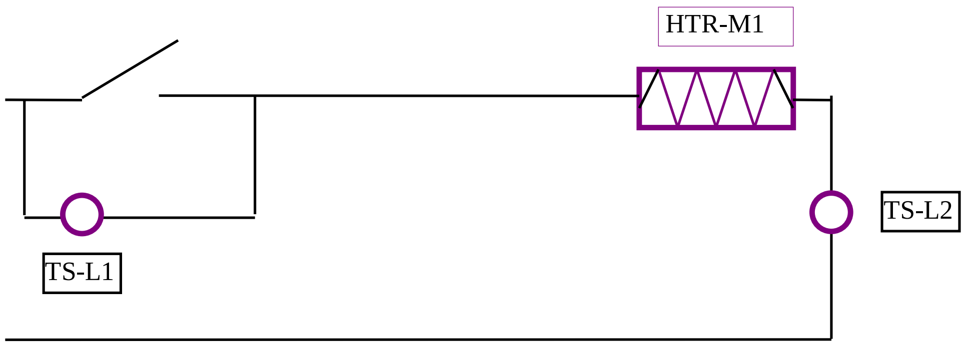


Scheme 7.24 (c) Thruster heater configuration

STR Head 1,2

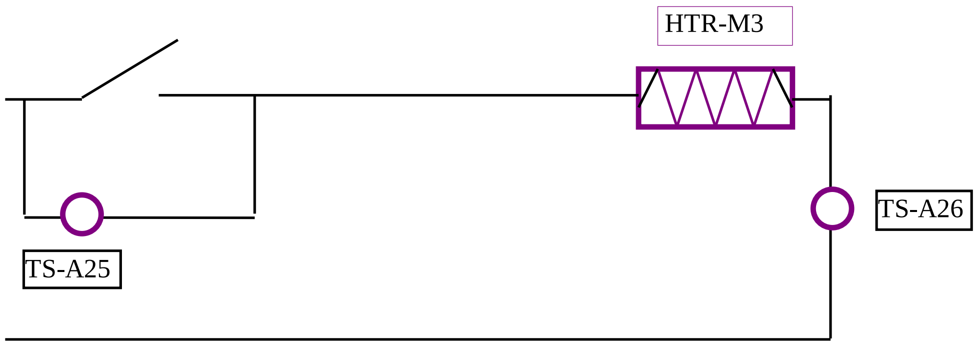
- Installed Thermal Power: 7.4 W

PDU LCL =6A.1.2 STRH 1 = 7.4 W



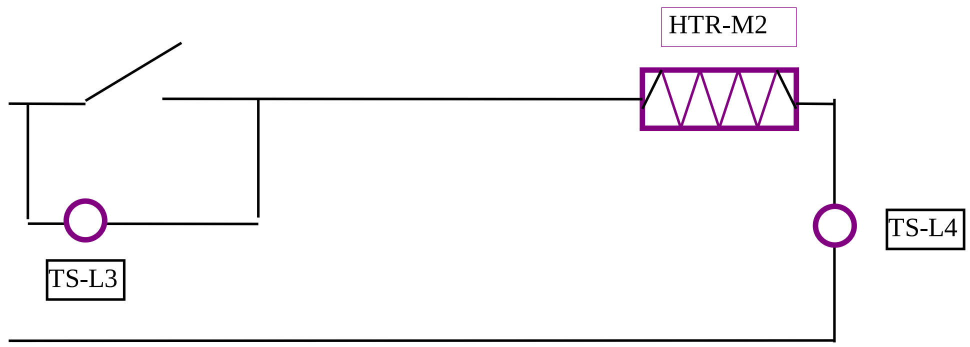
Scheme 7.25 (a): STRH 1 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.1.2 STRH 1 = 7.4 W



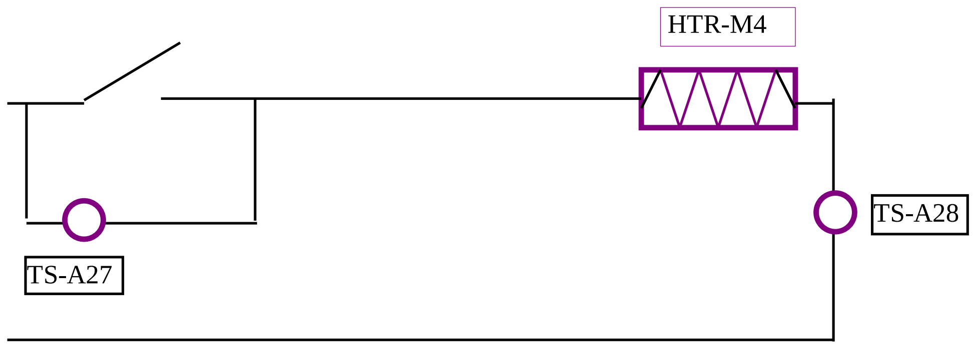
Scheme 7.25 (b): STRH 1 CONFIGURATION (REDUNDANT CIRCUIT)

PDU LCL =6A.1.3 STRH 2 = 7.4 W



Scheme 7.26 (a): STRH 2 CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.1.3 STRH 2 = 7.4 W

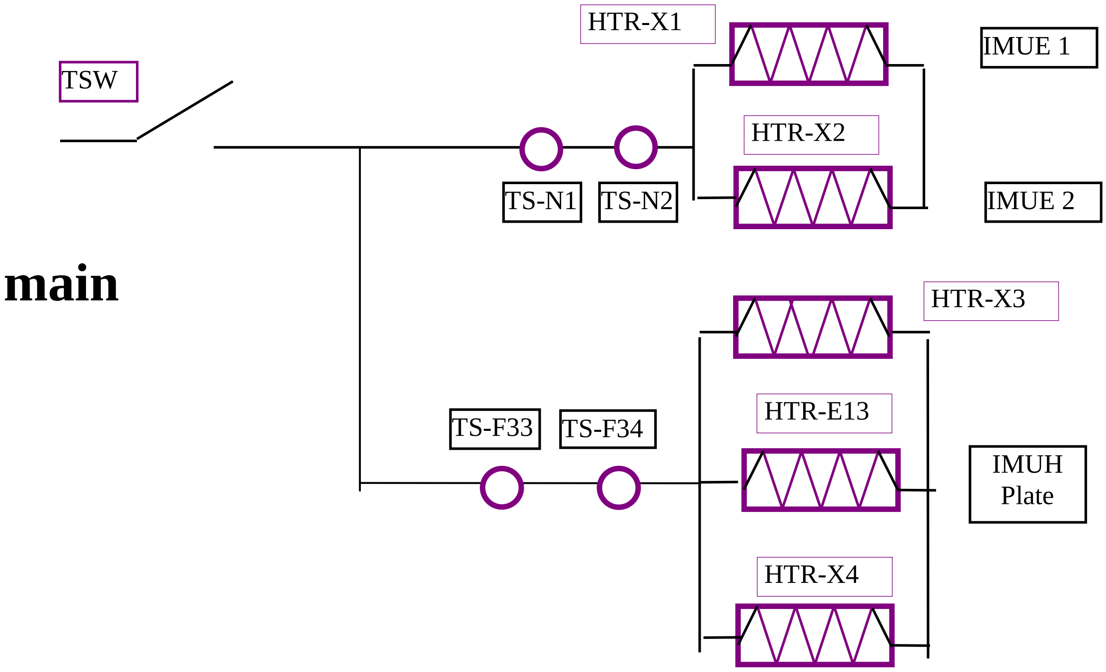


Scheme 7.26 (b): STRH 2 CONFIGURATION (REDUNDANT CIRCUIT)

TCS IMUE 1 & 2, IMUH Heaters

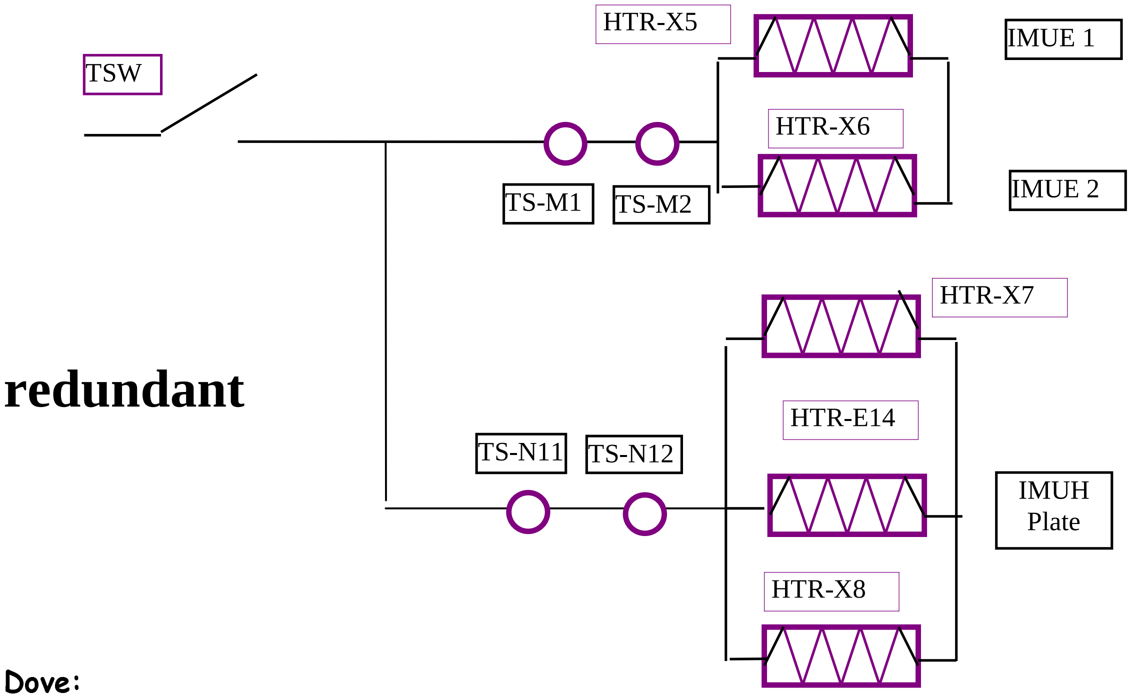
- Installed Thermal Power: 8 W

PDU LCL =6A.1.4 IMUE 1 & 2, IMUH = 4 W + 4 W + 4.W



Scheme 7.27 (a): IMUE 1 & 2, IMUH CONFIGURATION (MAIN CIRCUIT)

PDU LCL =6B.1.4 IMUE 1 & 2, IMUH = 4 W + 4 W + 4.W



Dove:

HTR –X = heater RICA :P/N 400900203CR0037 (R = 350 •)

TS- F = thermostat Elmwood: P/N 370200101BMLM04310250H3

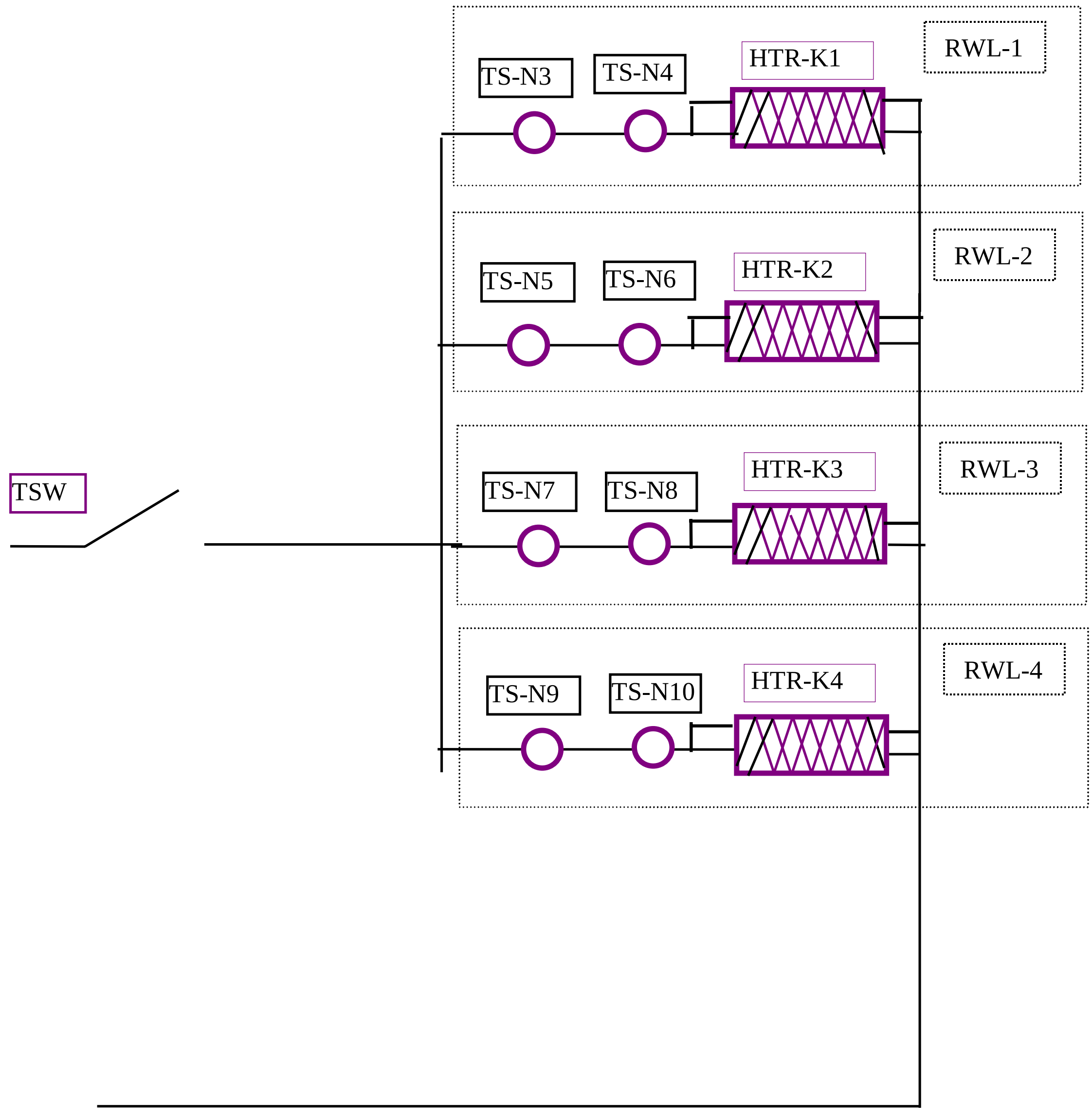
TS- N = = thermostat Comepa: P/N 370200101B015005H

Scheme 7.27 (b): IMUE 1 & 2, IMUH CONFIGURATION (REDUNDANT CIRCUIT)

TCS RWL Heaters

- Installed Thermal Power: 40. W

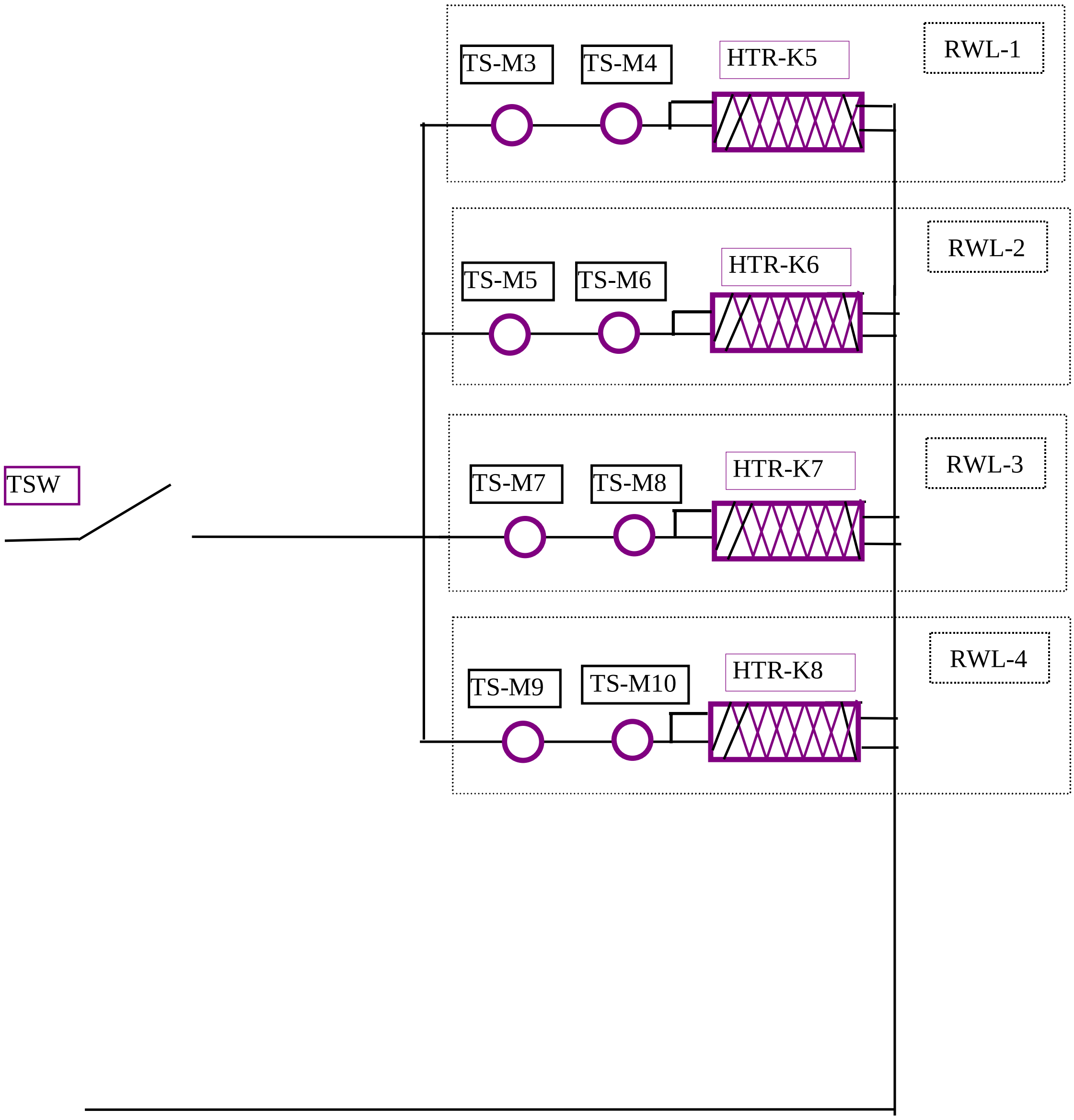
PDU LCL = 6A.1.5 RWL Heaters = 4 * (5. +5.) W



NOTE: each heater has 2 separate internal circuits, both must be connected in parallel.

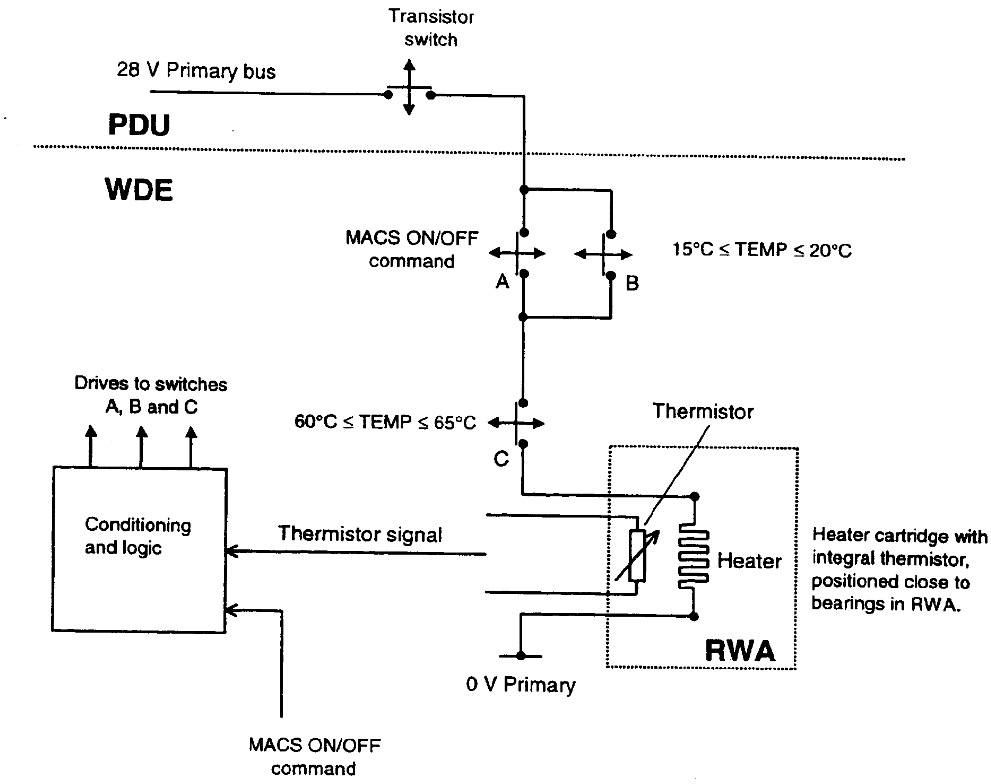
Scheme 7.28 (a): RWL CONFIGURATION (MAIN CIRCUIT)

PDU LCL = 6B.1.5 RWL Heaters = 4 * (5. +5.) W



<u>NOTE:</u> each heater has 2 separate internal circuits, both must be connected in parallel.

Scheme 7.28 (b): RWL CONFIGURATION (REDUNDANT CIRCUIT)



The MACS ON/OFF command controls the position of switch A. When switch A is open, switch B controls the bearing temperature between the limits of 15°C and 20°C. When switch A is closed, switch C ensures that the bearing temperature remains below 65°C. If switch A remains closed, switch C controls the bearing temperature between the limits of 60°C and 65°C.

Schematic of the RWU Heater Operation

Scheme 7.29 : RWA Configuration

7.2 HEATERS AND THERMOSTATS LOCATION

In the following pages the locations of heaters and thermostats are reported. For some equipment the location (or installation) is to be confirmed pending the FM analysis results.
OMC, SPI and JEM-X thermostats will be located inside the instruments and the relevant PI will define their locations. This is why they are not included in this document.
The same for IBIS Detector and Batteries: heaters and thermostats are shown for information only.

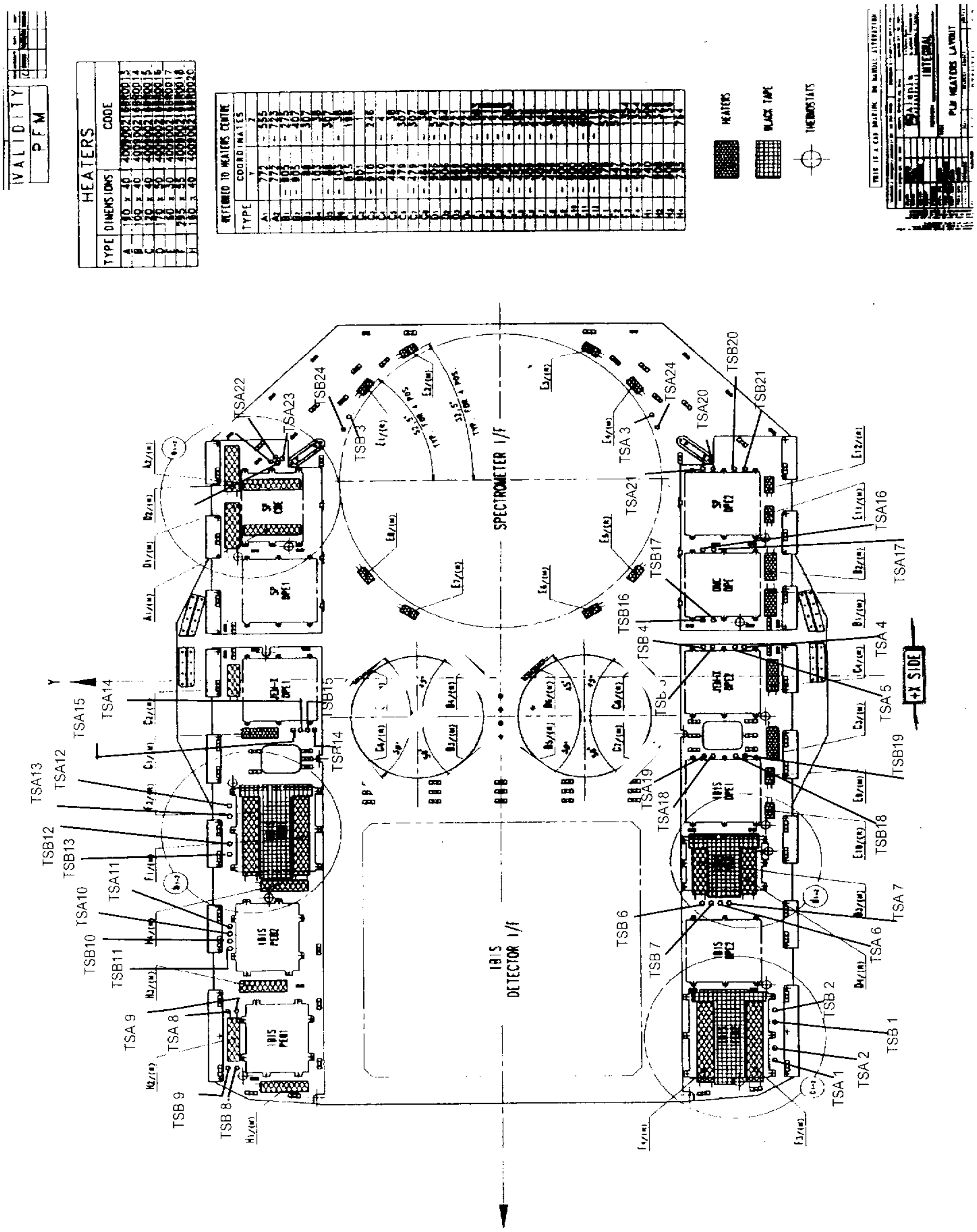
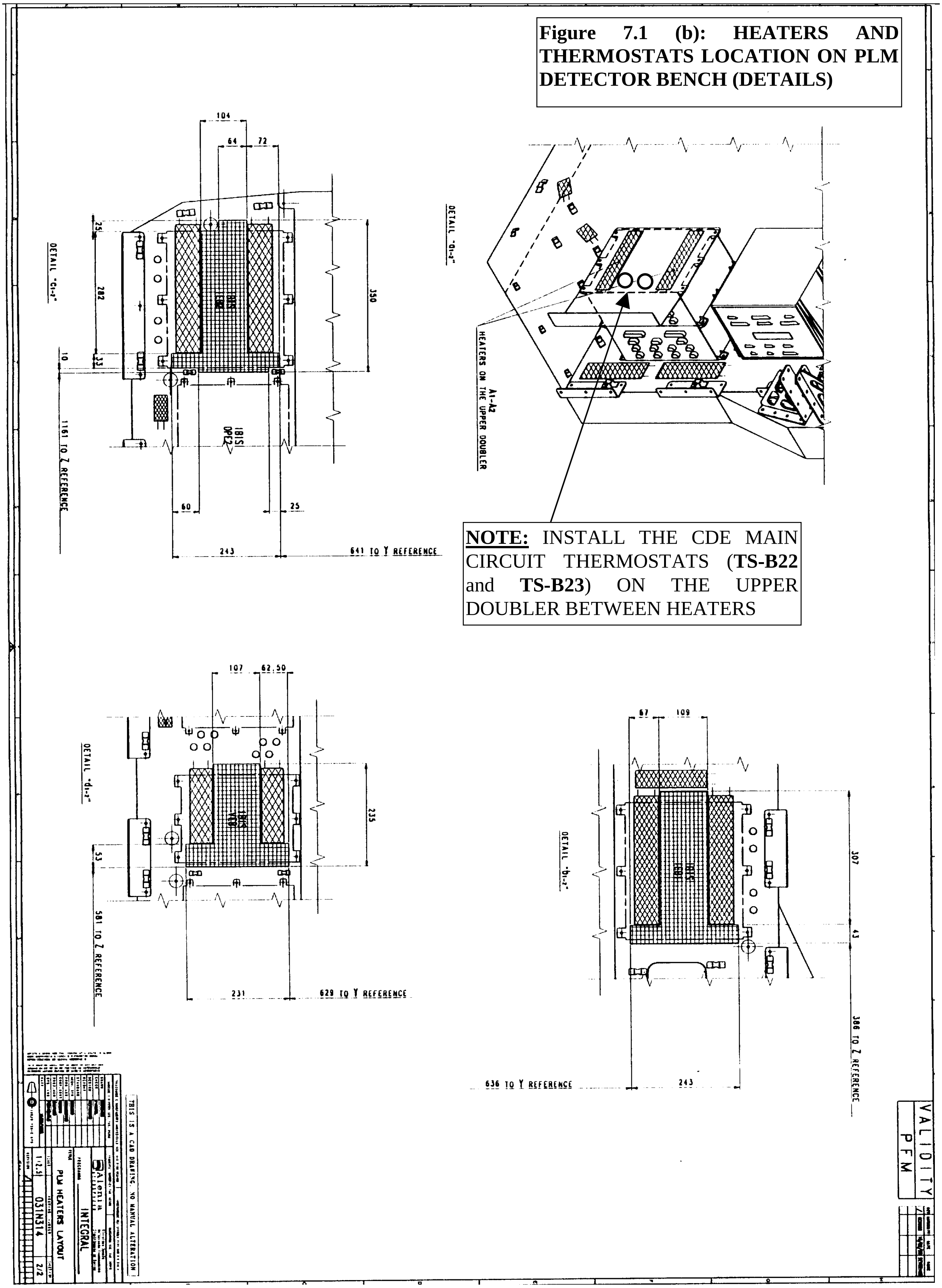


Fig. 7.1(a) Heater and Thermostats location on PLM Detector Bench

Figure 7.1 (b): HEATERS AND THERMOSTATS LOCATION ON PLM DETECTOR BENCH (DETAILS)



NOTE: INSTALL THE CDE MAIN CIRCUIT THERMOSTATS (**TS-B22** and **TS-B23**) ON THE UPPER DOUBLER BETWEEN HEATERS

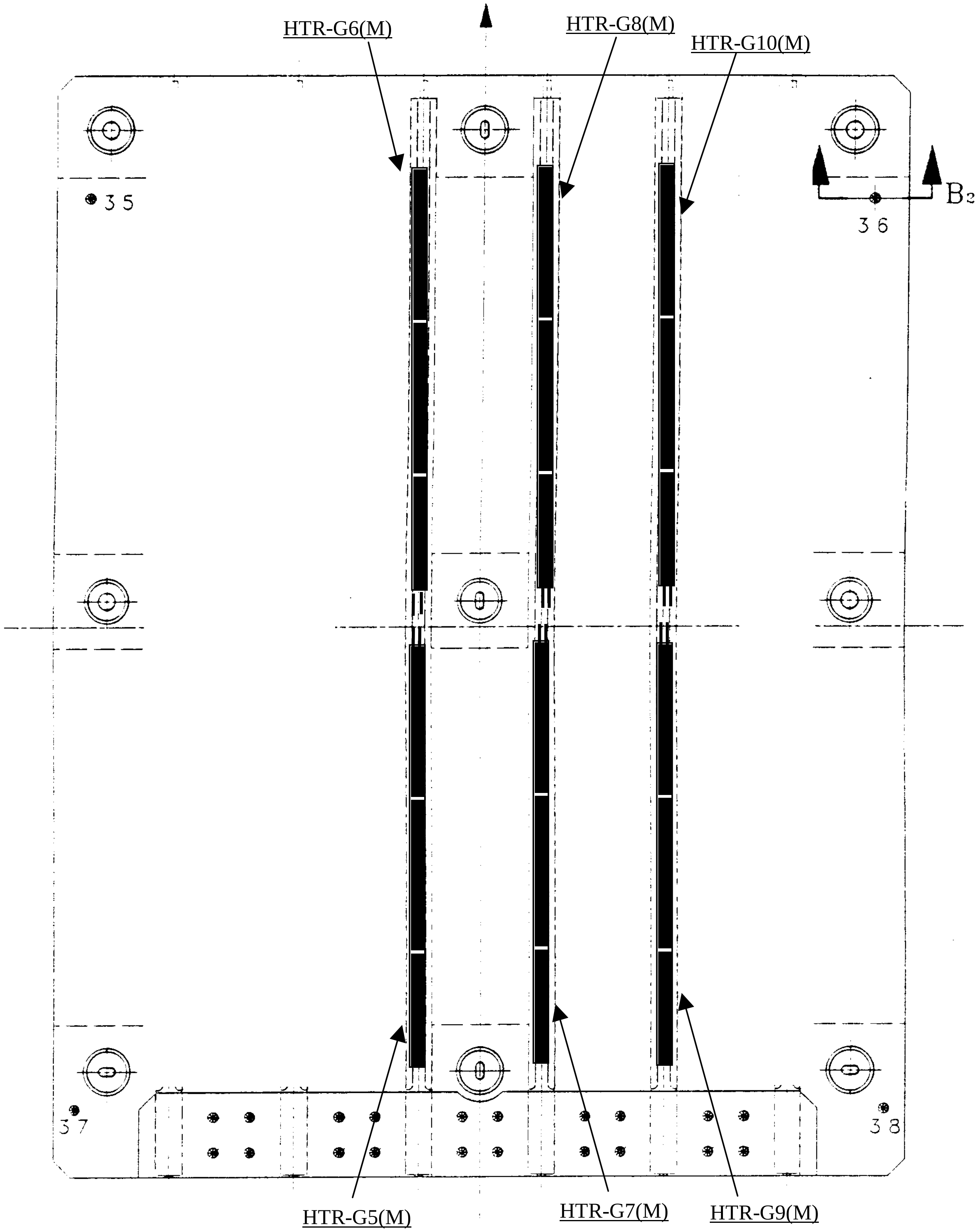


Figure 7.3 (a): HEATERS LOCATION ON TCA +Y RADIATOR

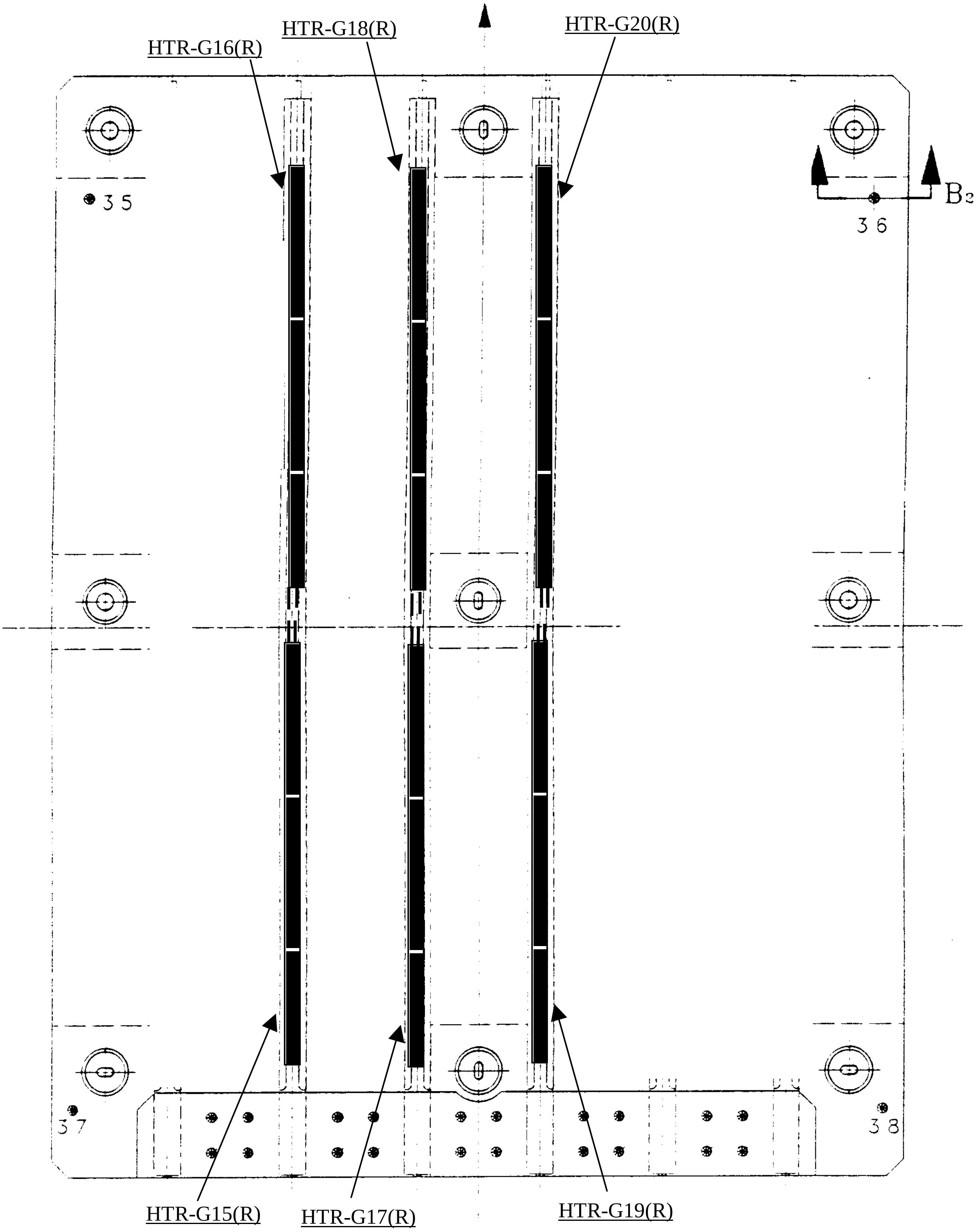


Figure 7.3 (b): HEATERS LOCATION ON TCA -Y RADIATOR

NOTE: ALL HEATERS MUST BE INSTALLED ON THE NOT ALUMINISED HALF OF THE TANK (paying attention to velcros and stand –off)

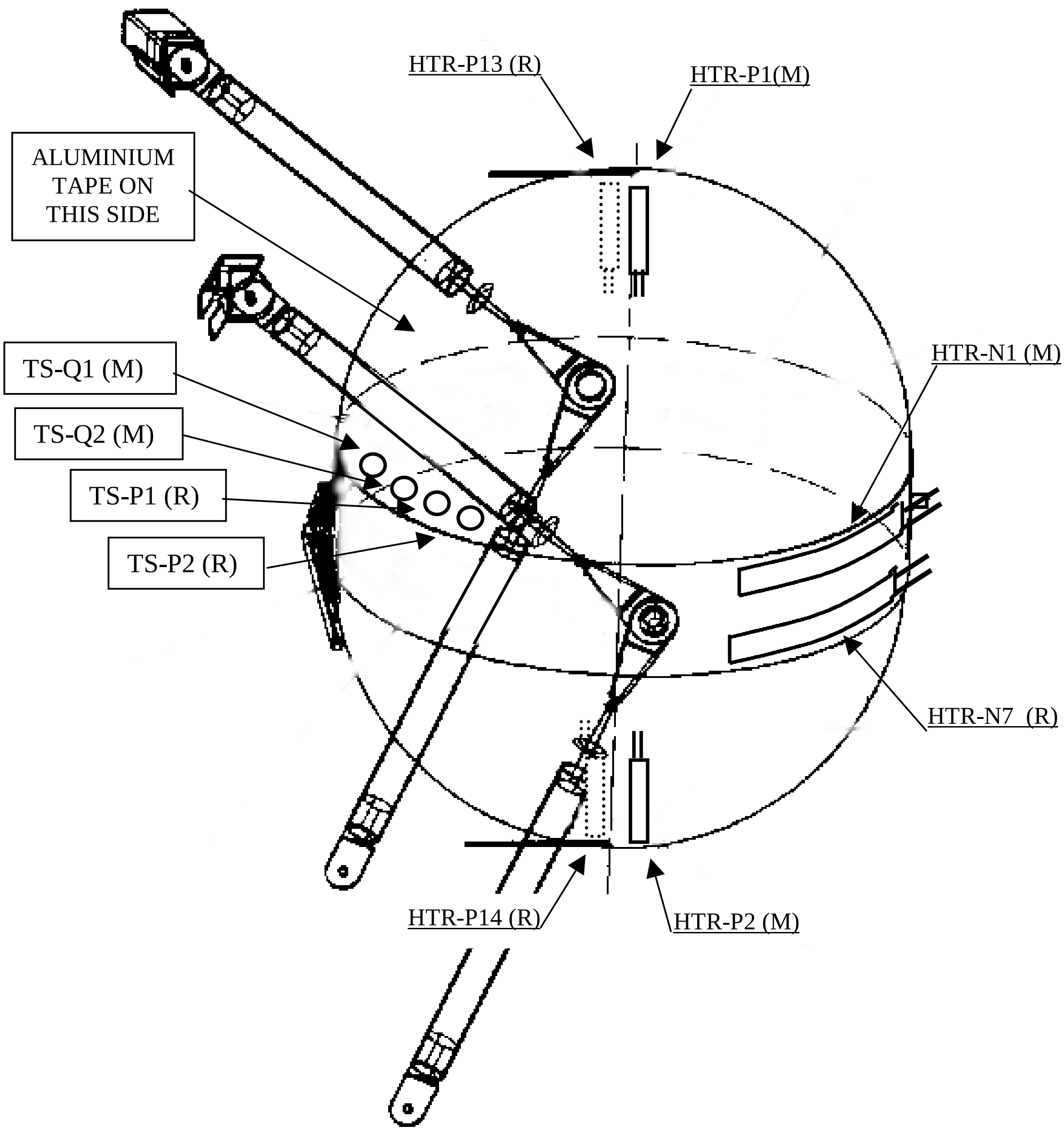


Figure 7.4: HEATERS AND THERMOSTATS LOCATION ON TANK 2 (+Z)

NOTE: FOR HEATERS AND THERMOSTATS INSTALLATION PAY ATTENTION TO VELCROS AND STAND –OFF (dedicated to MLI)

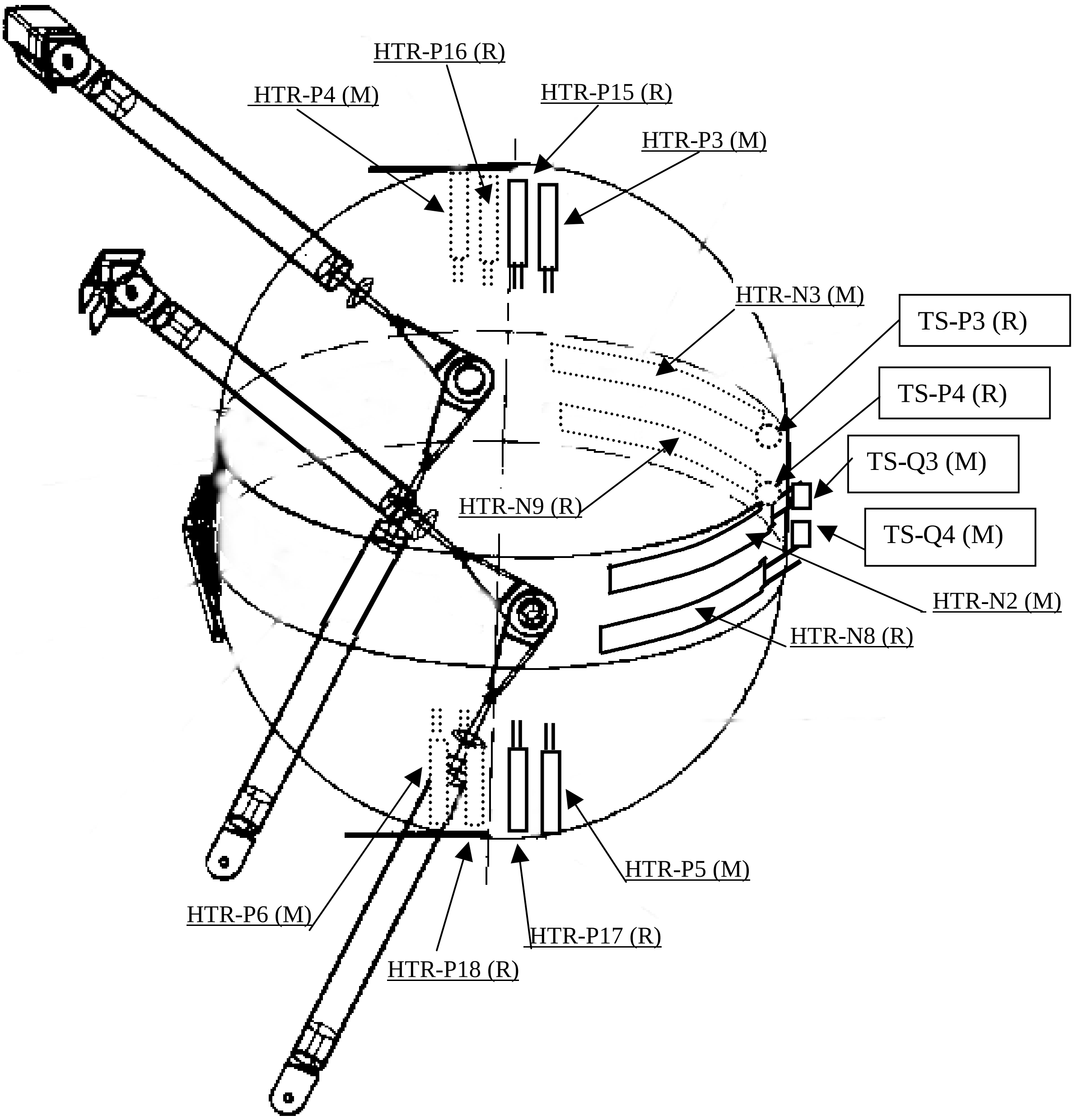


Figure 7.5: HEATERS AND THERMOSTATS LOCATION ON TANK 4 (- Z)

NOTE: ALL HEATERS MUST BE INSTALLED ON THE NOT ALUMINISED HALF OF THE TANK (paying attention to velcros and stand –off)

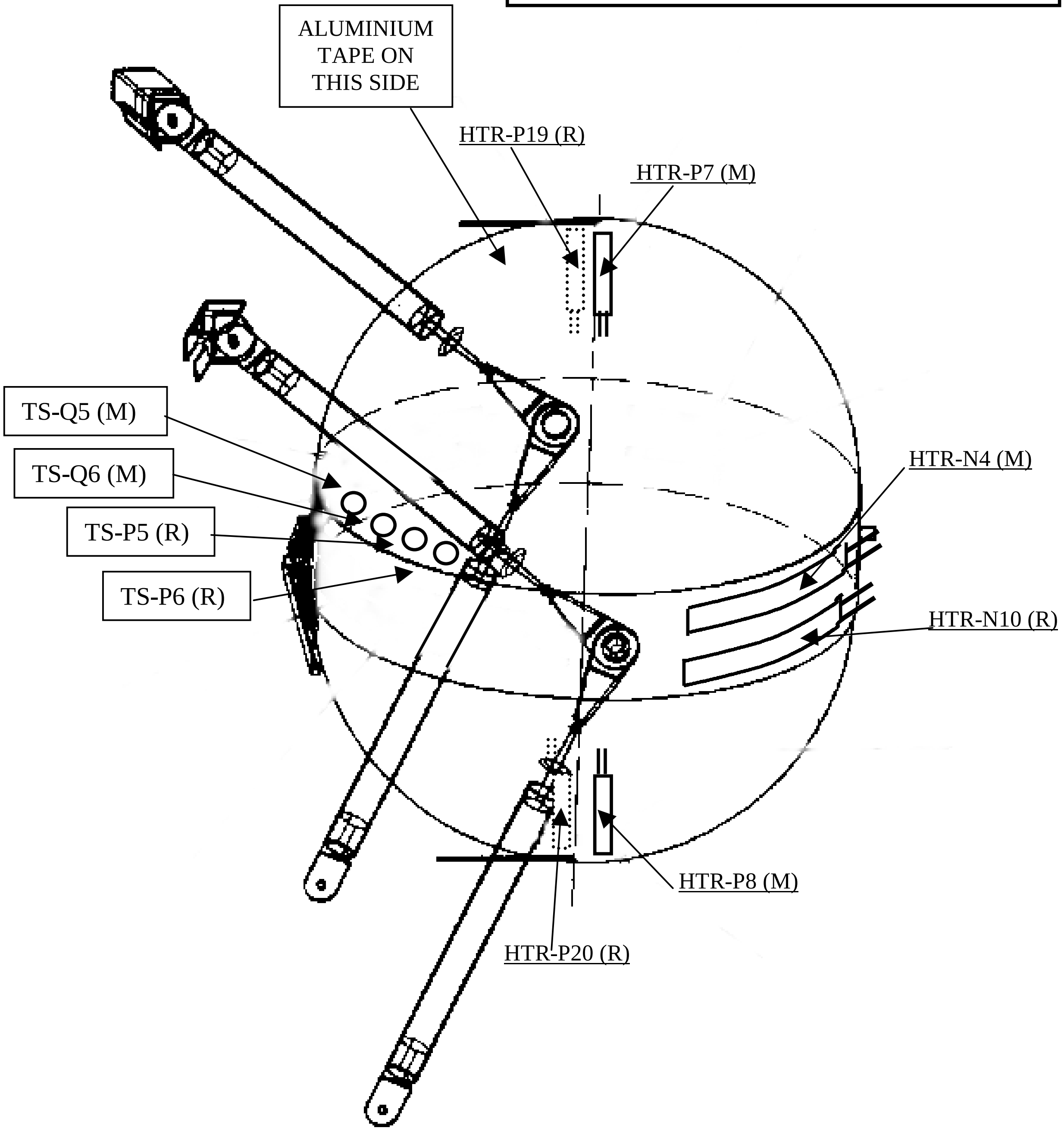


Figure 7.6: HEATERS AND THERMOSTATS LOCATION ON TANK 3 (+ Z)

NOTE: FOR HEATERS AND THERMOSTATS INSTALLATION PAY ATTENTION TO VELCROS AND STAND –OFF (dedicated to MLI)

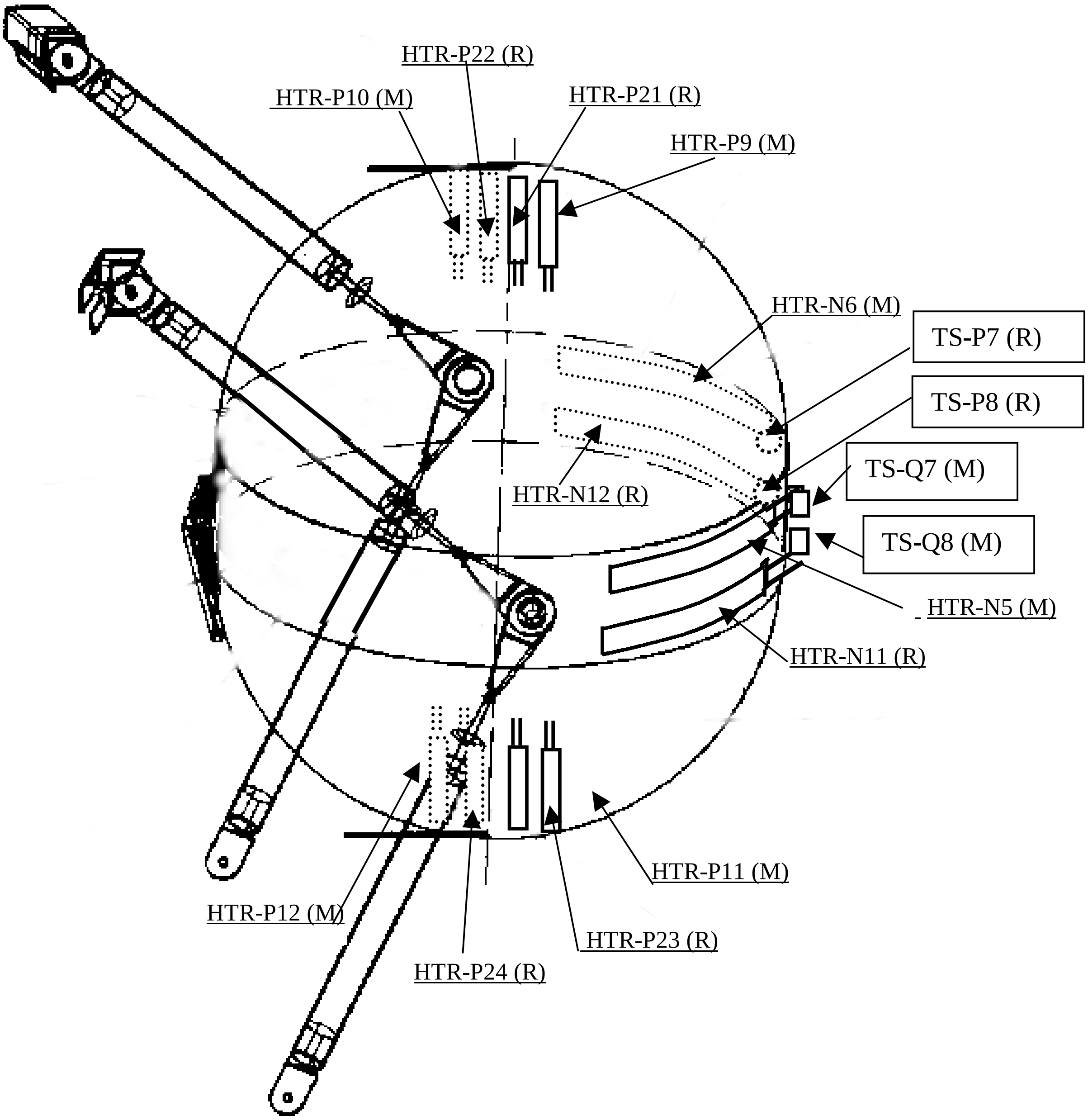


Figure 7.7: HEATERS AND THERMOSTATS LOCATION ON TANK 1 (-Z)

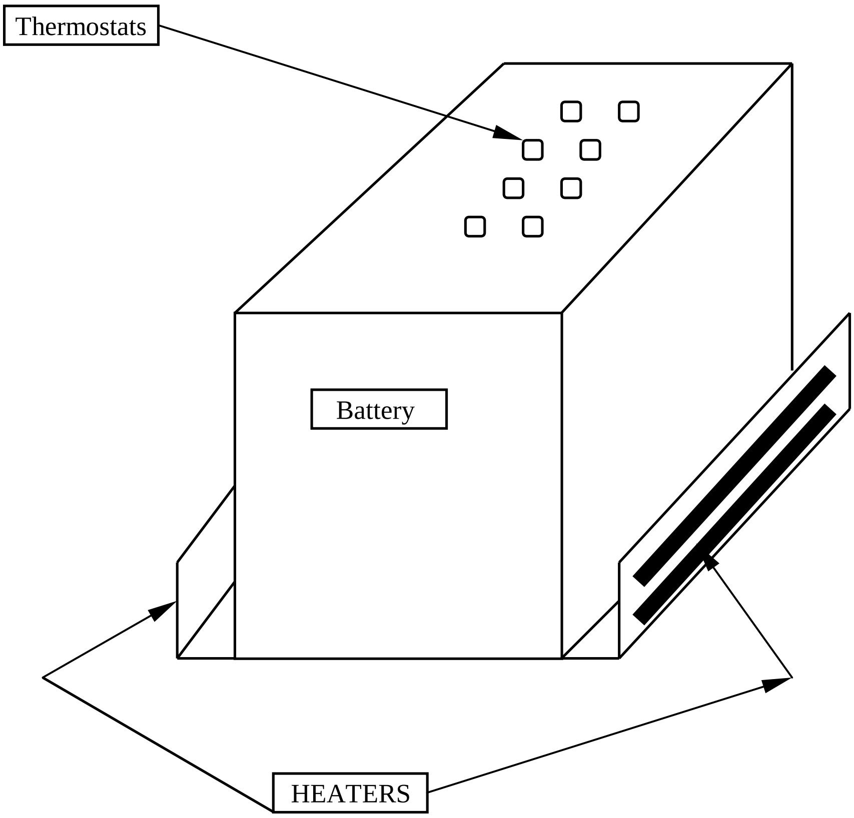


Figure 7.8: HEATERS AND THERMOSTATS LOCATION ON BATTERIES (FOR INFORMATION ONLY)

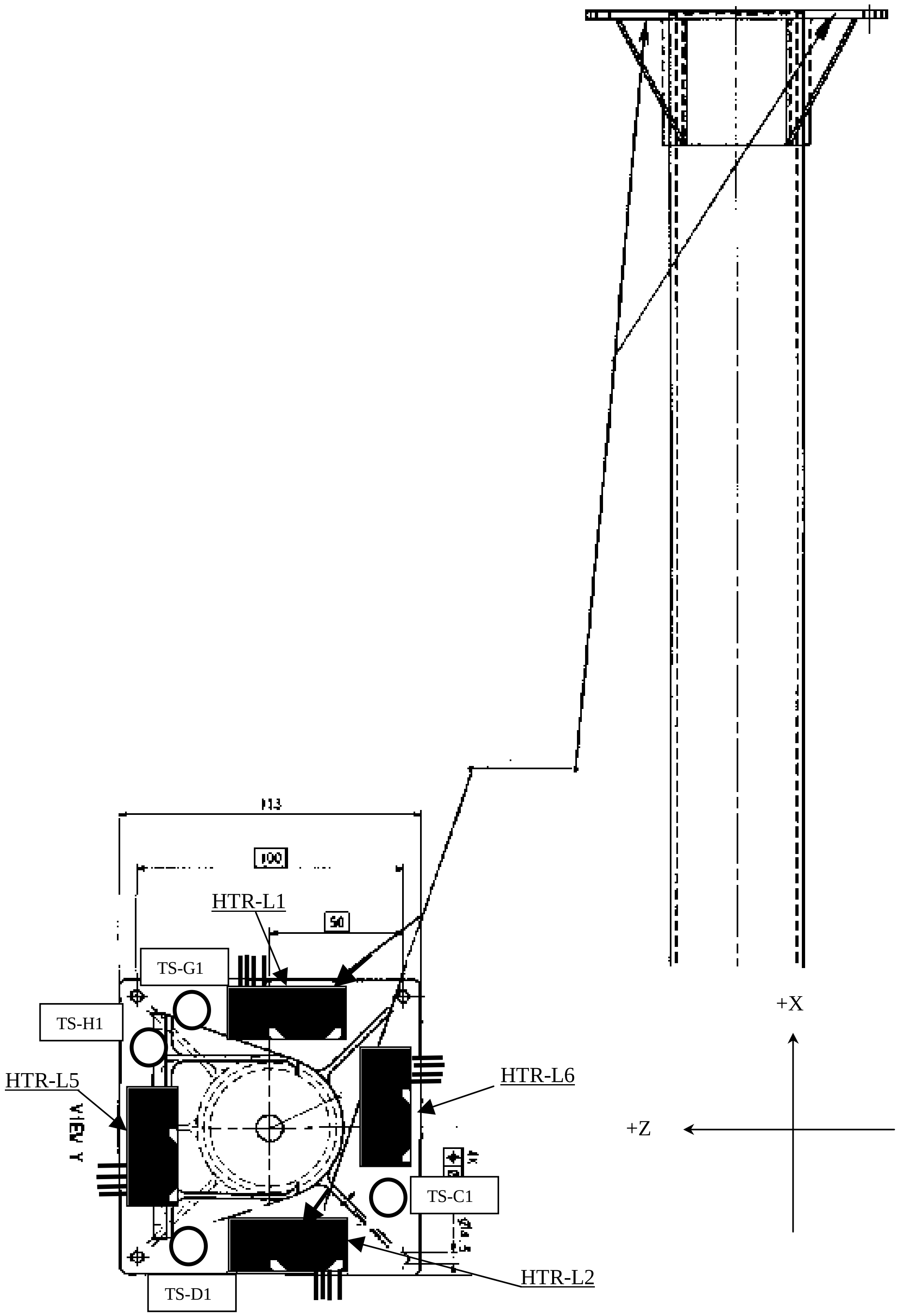


Figure 7.9: HEATERS AND THERMOSTATS LOCATION ON SAS +Y

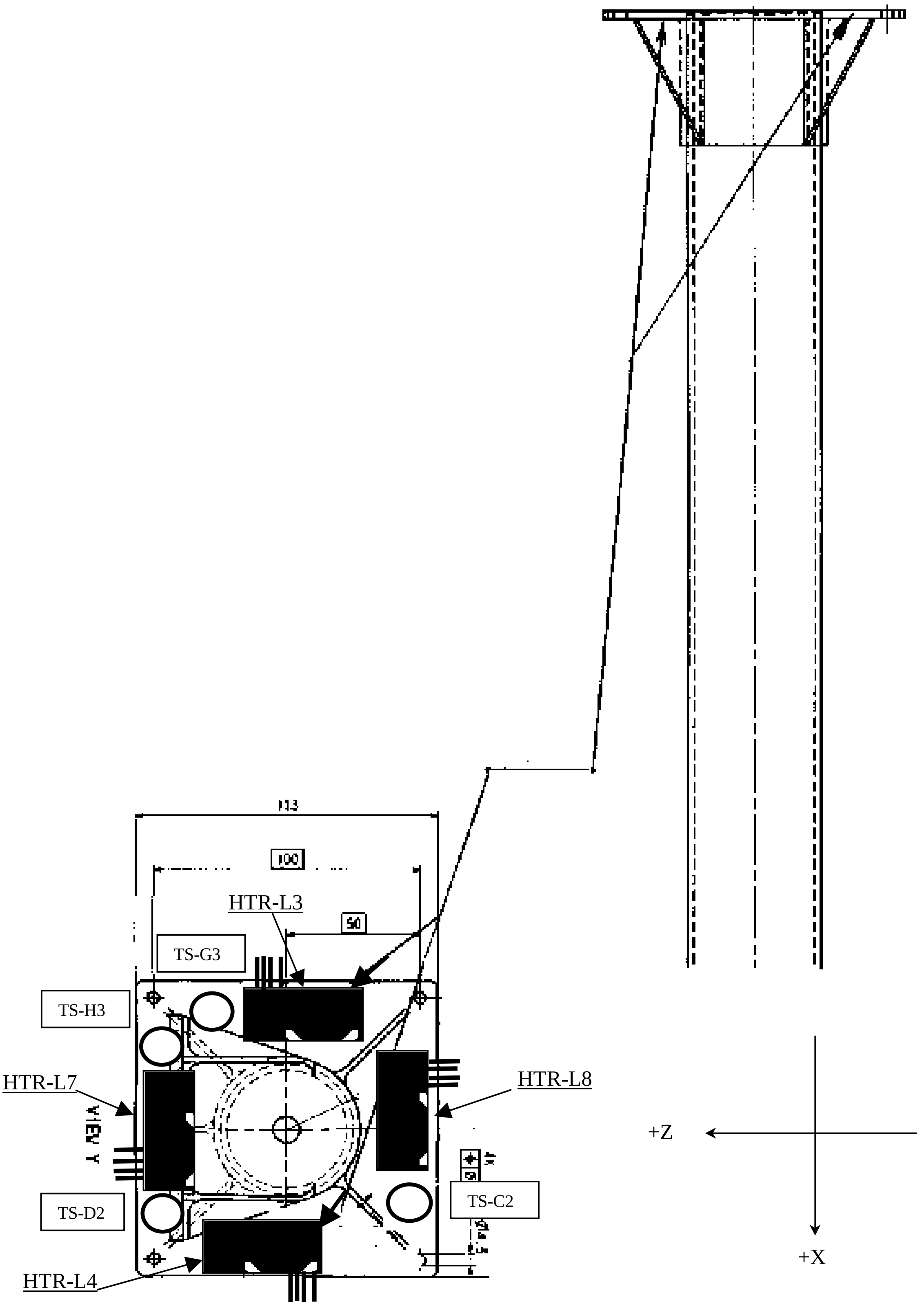


Figure 7.10 (a): HEATERS AND THERMOSTATS LOCATION ON SAS -Y

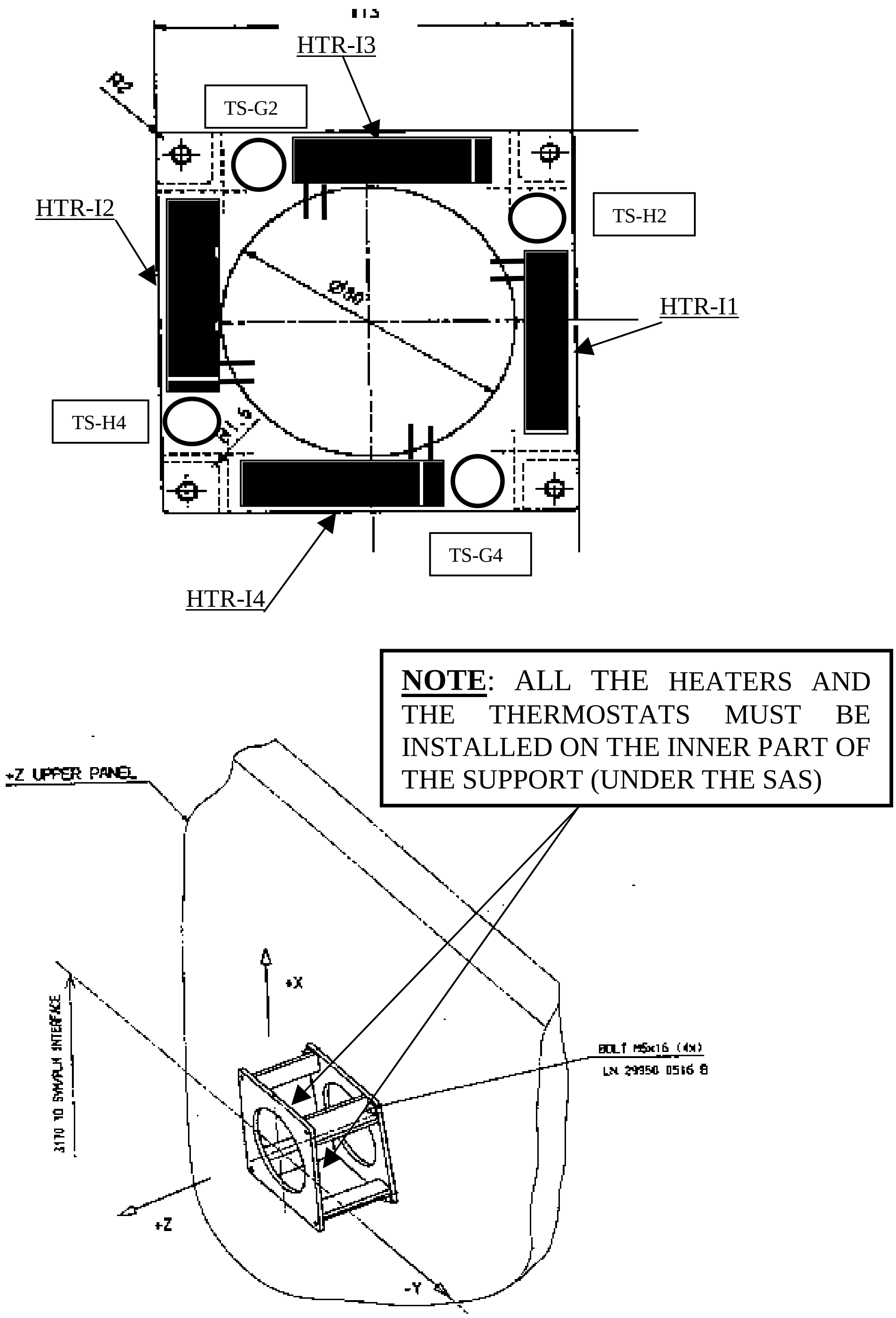
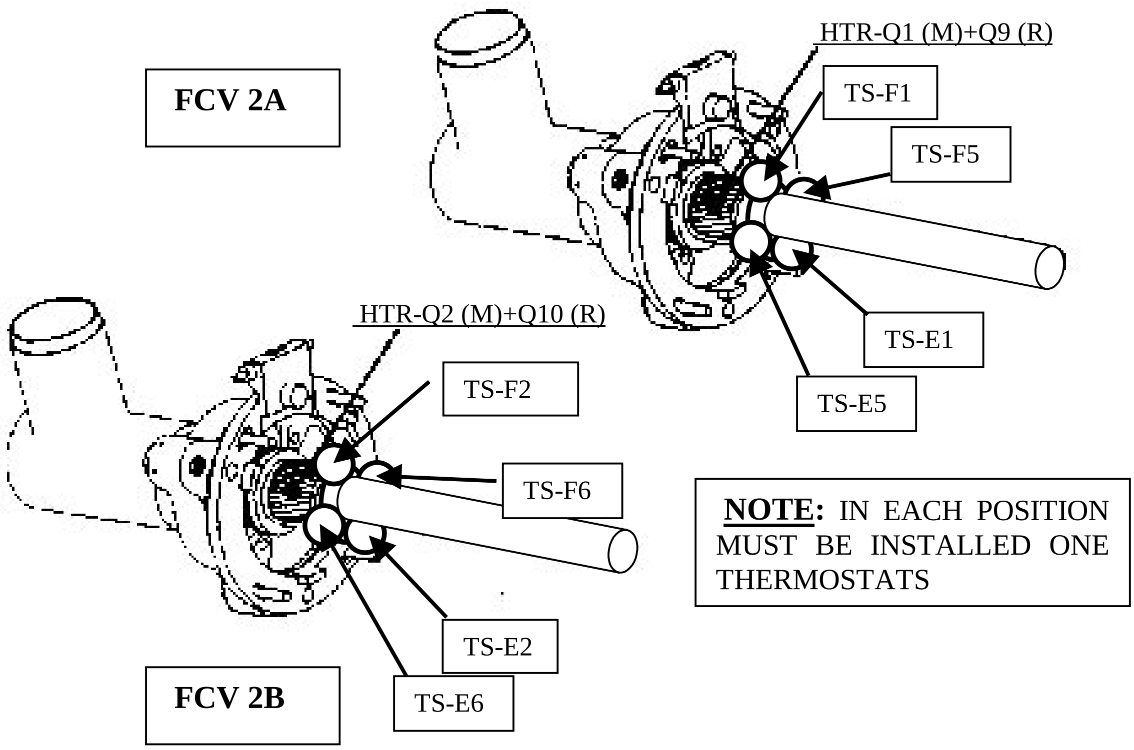
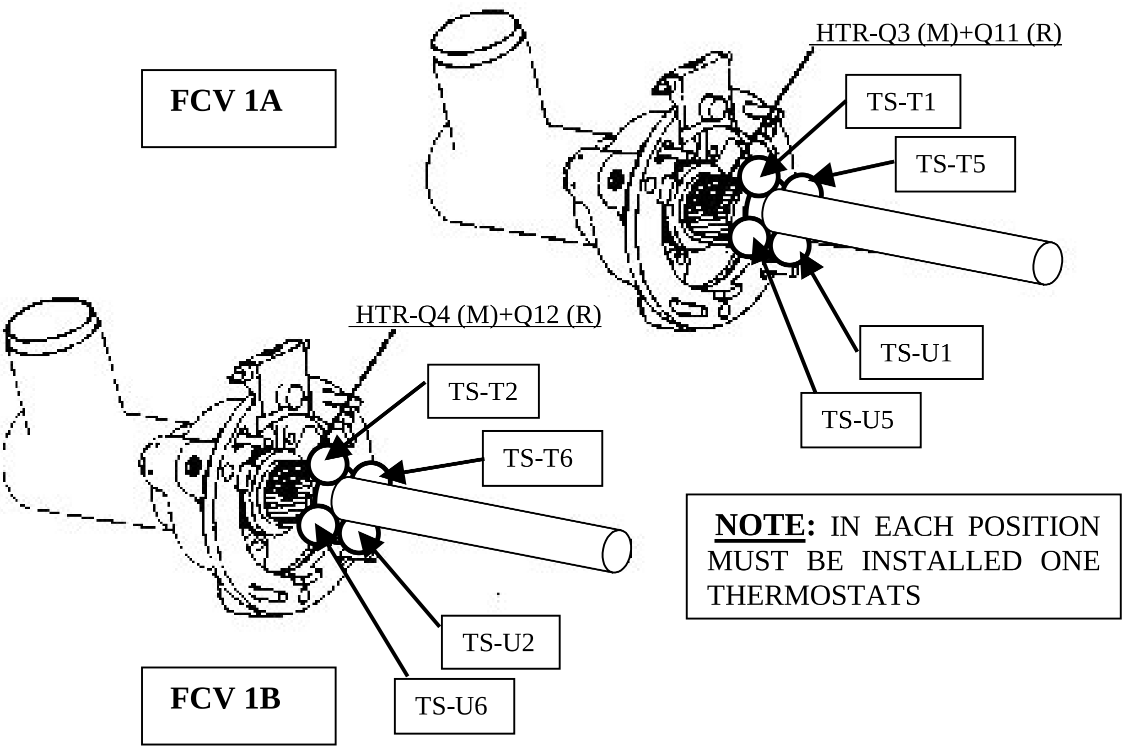


Figure 7.10 (b): HEATERS AND THERMOSTATS LOCATION ON SAS +Z



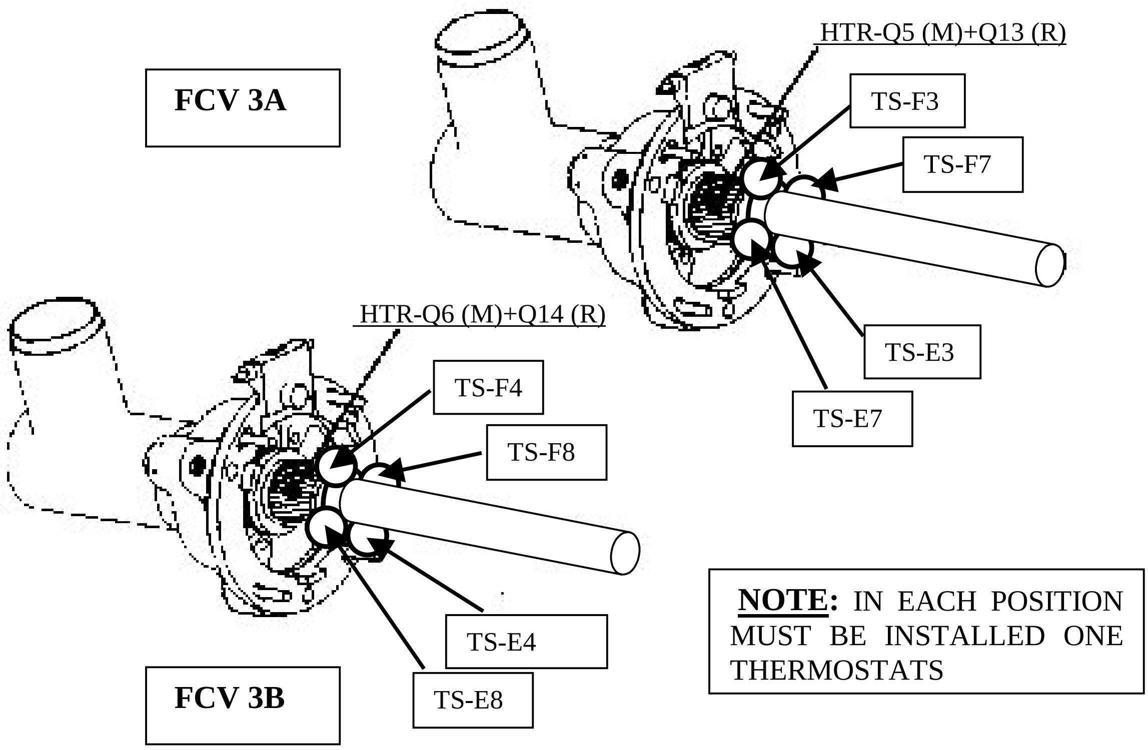
***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

Figure 7.11: HEATERS AND THERMOSTATS LOCATION ON FCV 2 (+Z)



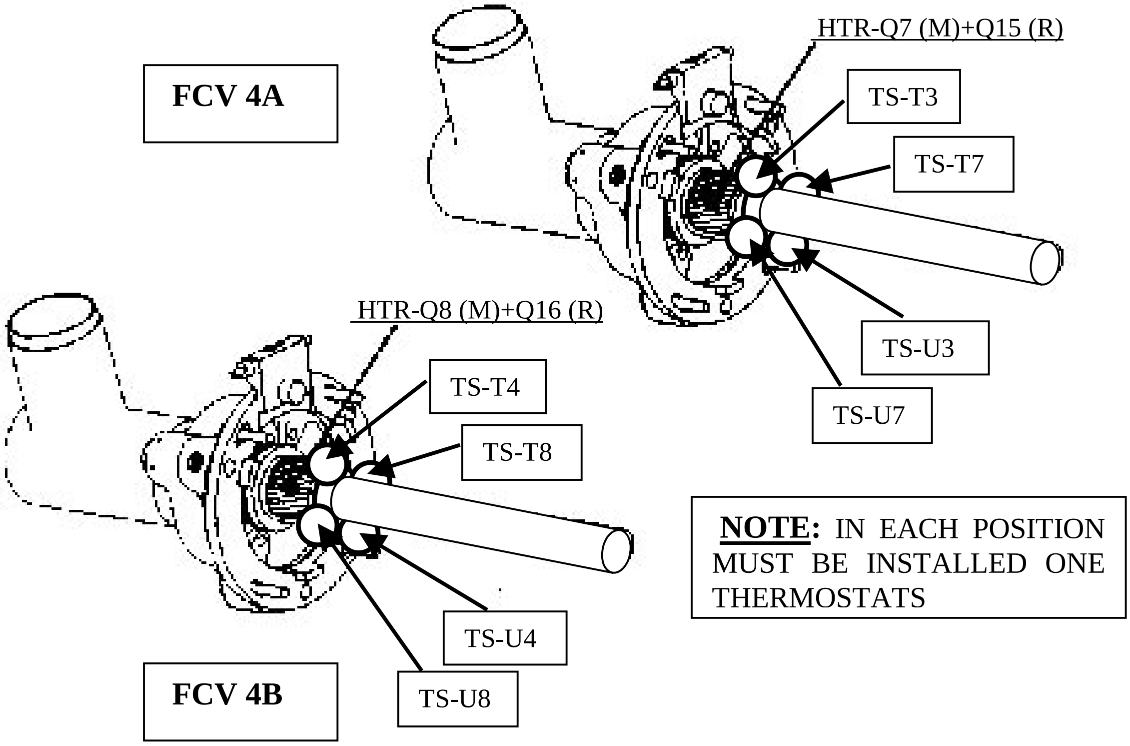
***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

Figure 7.12: HEATERS AND THERMOSTATS LOCATION ON FCV 1 (-Z)



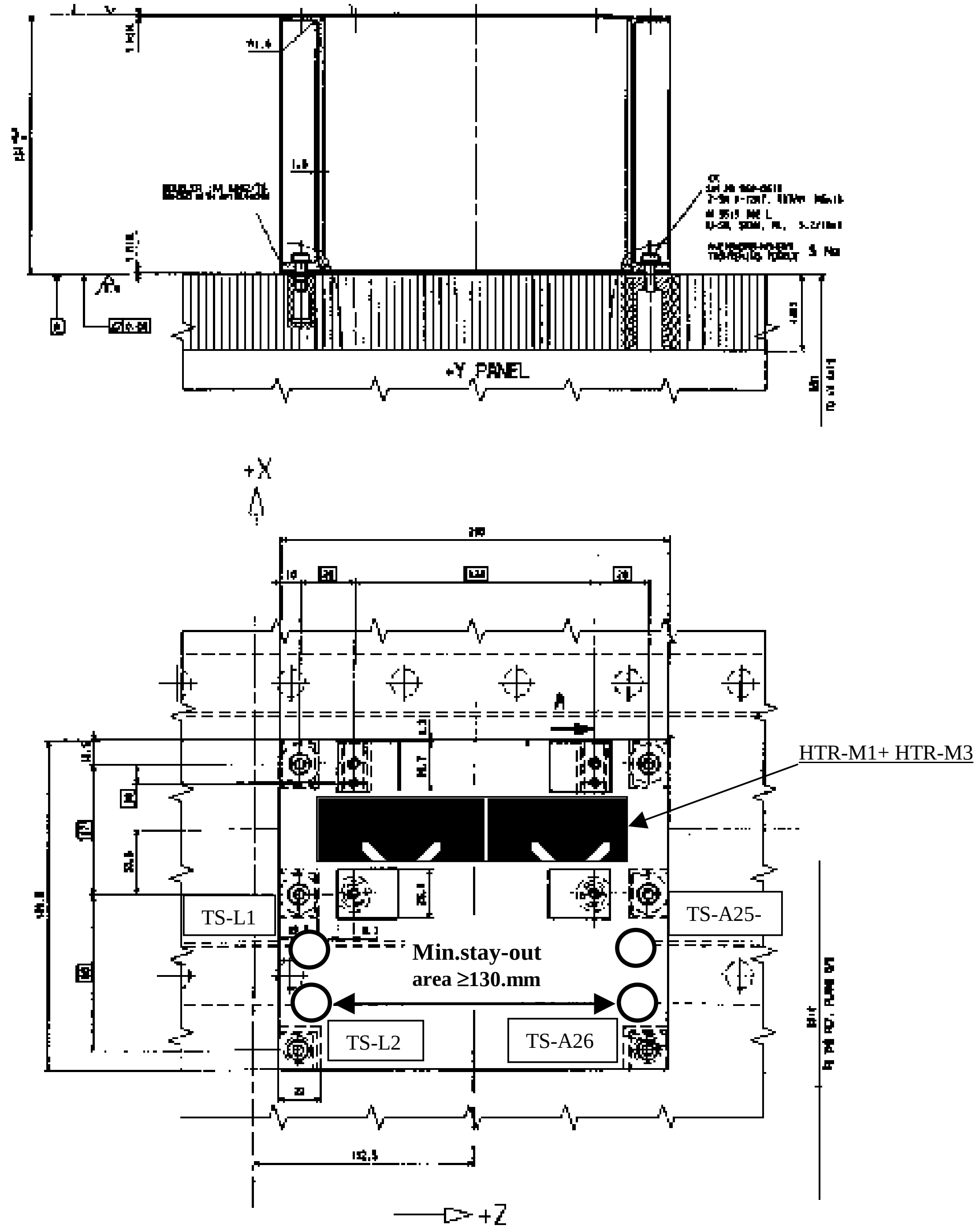
NOTE*: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

Figure 7.13: HEATERS AND THERMOSTATS LOCATION ON FCV 3 (+Z)



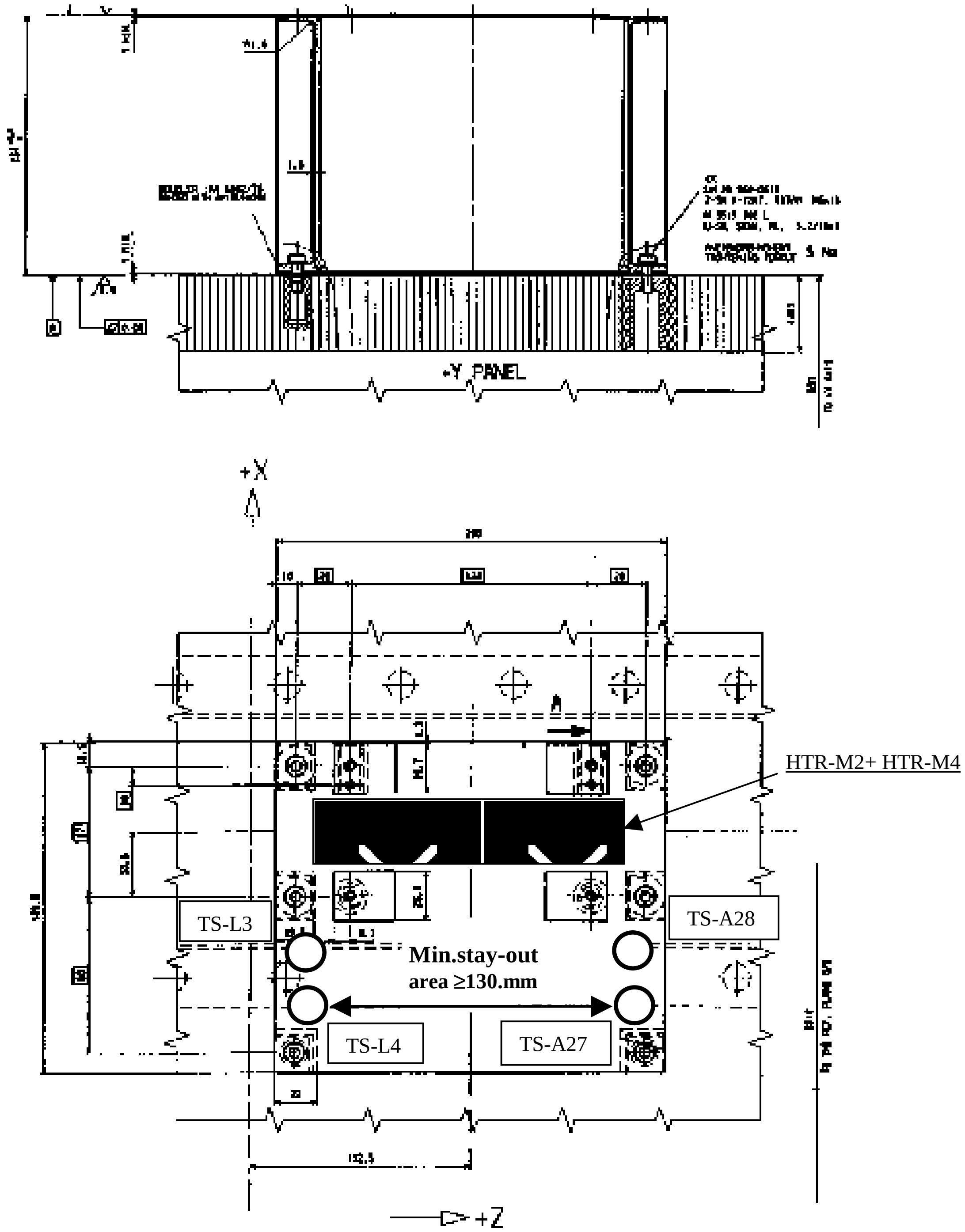
***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

Figure 7.14: HEATERS AND THERMOSTATS LOCATION ON FCV 4 (-Z)



__NOTE__: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)

Figure 7.15: HEATERS AND THERMOSTATS LOCATION ON THE MOUNTING PANEL, UNDER STRH 1



***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

Figure 7.16: HEATERS AND THERMOSTATS LOCATION ON THE MOUNTING PANEL, UNDER STRH 2

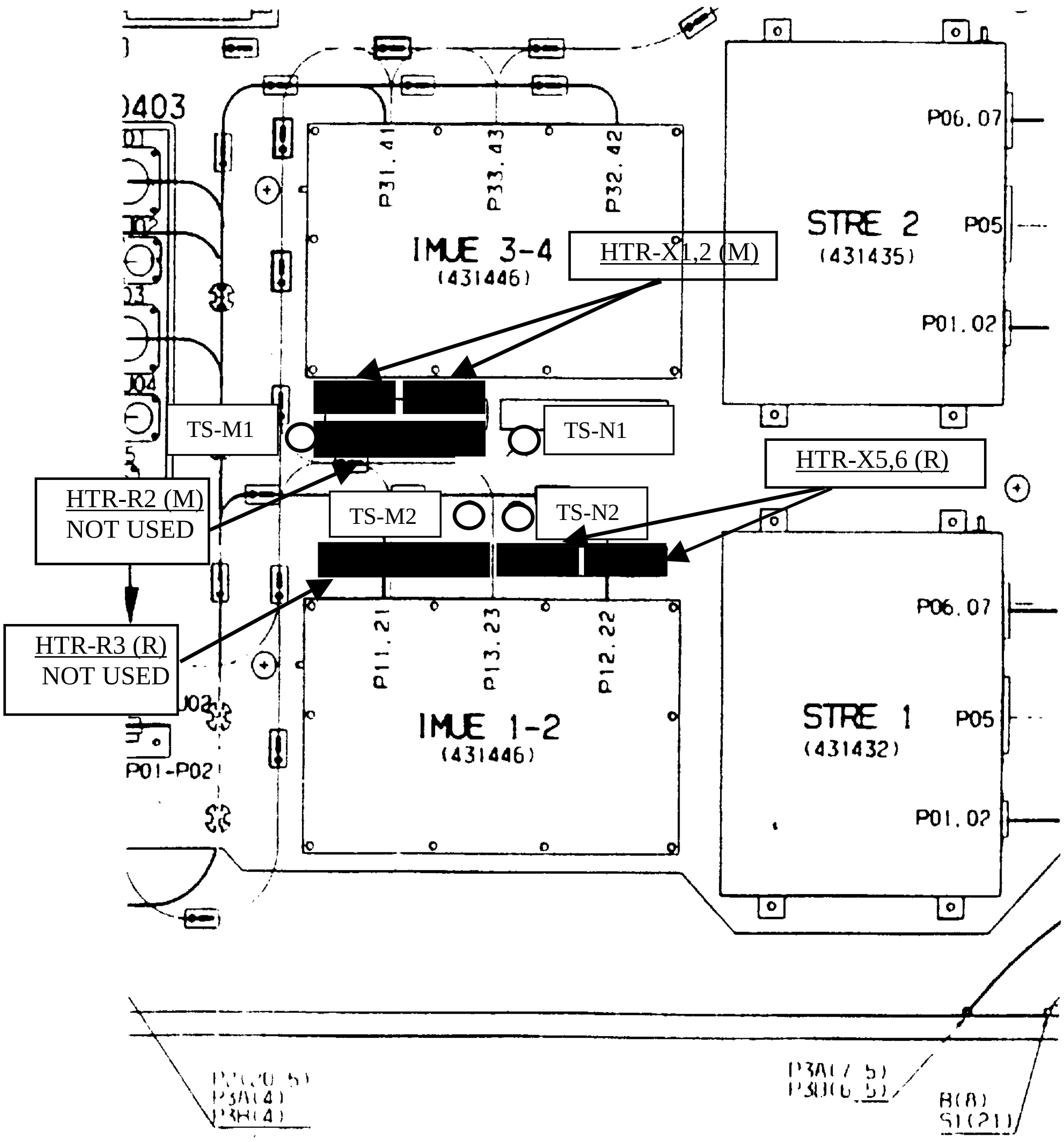


Figure 7.17(a): HEATERS AND THERMOSTATS LOCATION ON IMUE 1 & 2

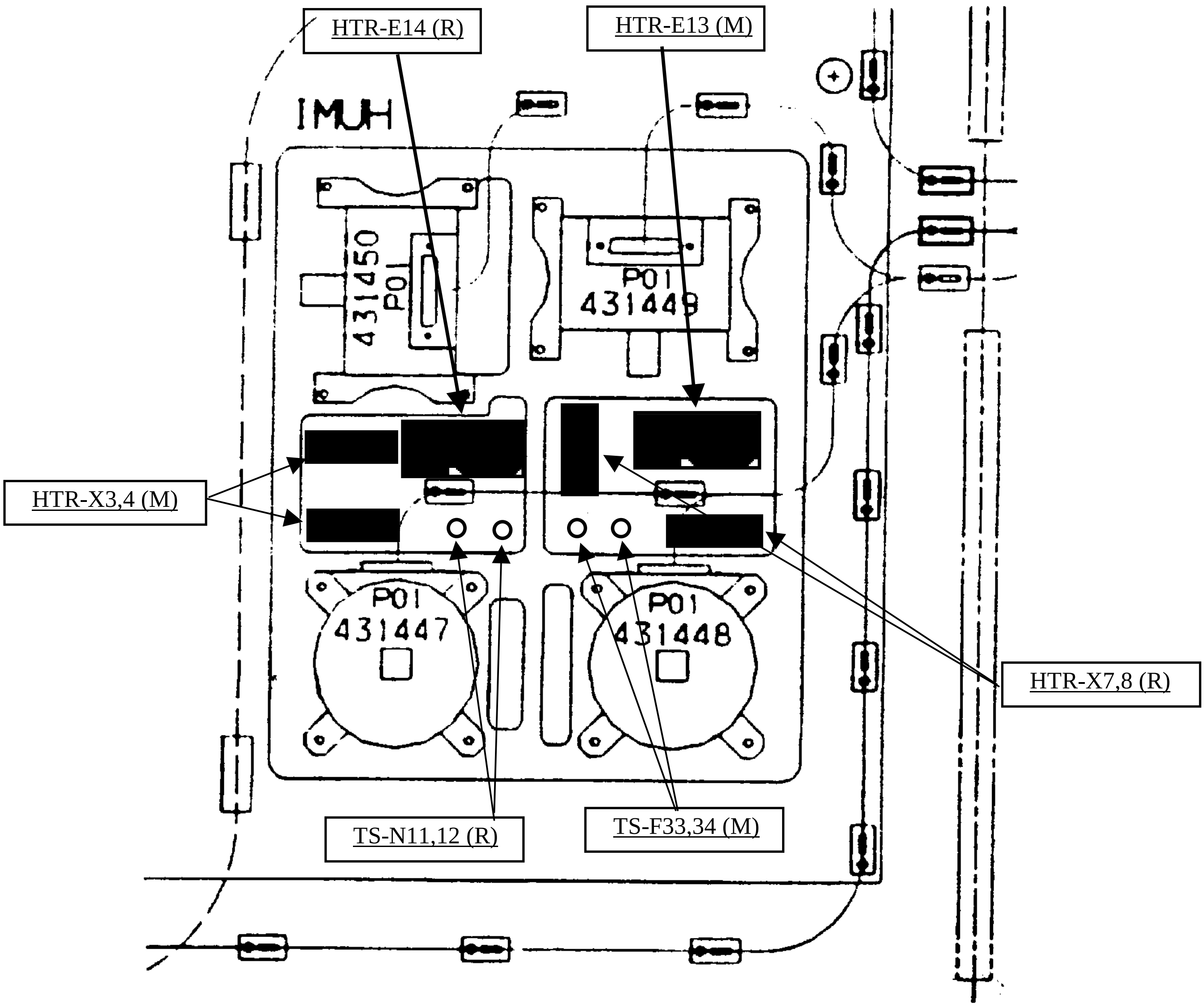
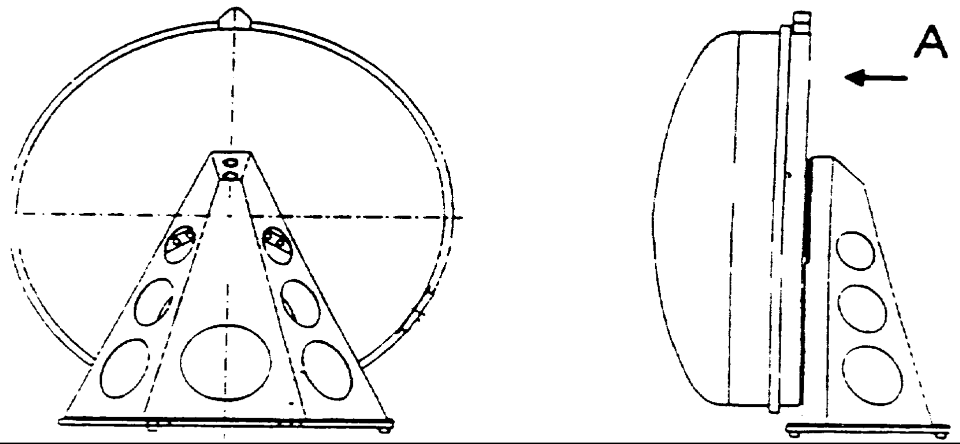


Figure 7.17(b): HEATERS AND THERMOSTATS LOCATION ON IMUH



NOTE: HEATERS AND THERMOSTATS CABLES ARE REQUESTED TO BE FIXED ONLY ON RWL COVER AND THEN DIRECTLY TO THE S/C FLOOR (the possibility to dismount the RWL from its support must be considered). A CIRCULAR CENTRAL AREA OF Φ = 160.mm MUST BE LEFT FREE

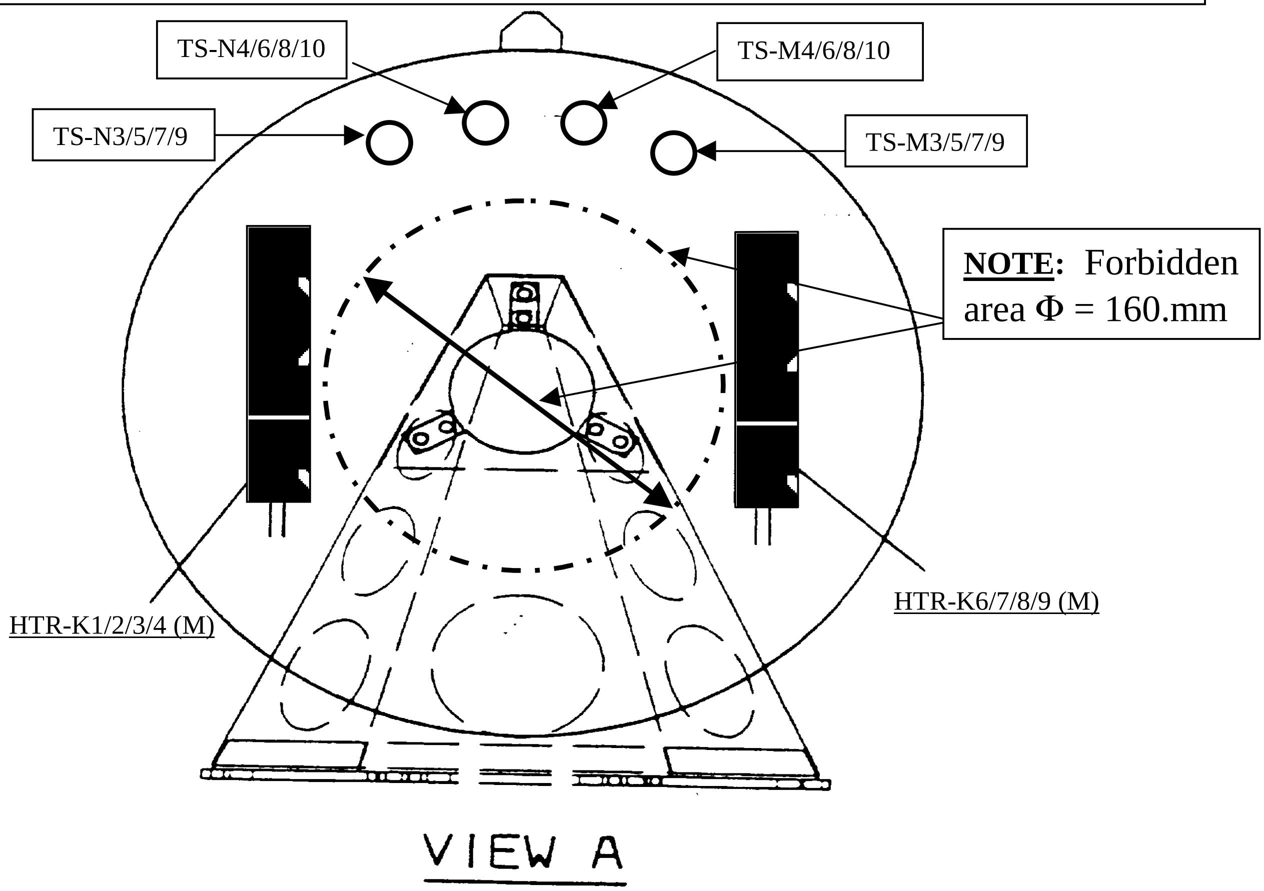


Figure 7.18 : HEATERS AND THERMOSTATS LOCATION ON RWL 1/2/3/4 (TYPICAL POSITION)

8. RCS LINES HEATERS AND THERMOSTATS

The RCS assembly includes the following items:

- RCS piping
- Pressure Transducers (PT)
- Latching Valves (LV)
- Liquid Filters (LF)

For INTEGRAL RCS TCS are used both thermofoil and Clayborn heaters, divided into 12 main (A) and 12 redundant (B) lines. Each line includes different number and types of heaters and two thermostats. The main and the redundant RCS line are in the same heater.
Note that the installation layout of thermostats on each PT is different.
The schemes 8.1 and 8.2 report the electrical nominal and redundant configurations, heater type and resistance and also thermostat type and definition (according to table 3.1).
Thermofoil heaters installation layout on RCS units is shown in figures 8.1, 8.2 and 8.3. Clayborn heaters on piping, thermofoil shunt heaters on upper platform (-X side), thermostats and thermistors on piping (shown in figures 8.4 ÷ 8.15) or on dedicated supports (see sketch 8.1 in general and figure 8.3(a) for liquid filters).
Further details, such as length, power and installation layout are reported in AD 2.

For RCS piping before Clayborn heaters installation the pipe must be wrapped with Kapton tape in order to avoid electrical insulation problems.
Both for RCS units (LV, LF and PT) and for piping, after heaters, thermostats and thermistors installation the whole item must be completely covered with an aluminium layer (CHO-FOIL) paying attention at the *insulation of connections* on thermostats (ref. para. 3.1).

It is hereafter reported again a part of table 5.1 which includes the list of thermofoil heaters and a new table (8.1) containing type and characteristic of Clayborn heaters used for RCS

Type	PART NUMBER	Quantity (N+R)	HEATER Resistance [Ω]	HEATER Nominal Power @ 26.5V [W]	HEATER Dimensions X [mm]	HEATER Dimensions Y [mm]	REMARKS (used for:)
HTR-S	400900203CR0042	2 + 2	303	2.3	75.2	24.6	RCS shunt
HTR-T	400900203CR0041	5 + 5	103	6.8	125.7	22.9	RCS shunt
HTR-U	400900203CR0040	1 + 1	220	3.2	50.	19.8	PT 2 (*)
HTR-V	400900203BR0040	1 + 1	220	3.2	50.	19.8	PT 3 (*)
HTR-W	400900203CR0043	4 + 4	206	3.4	69.9	24.9	LF1&2, LV1&2 (*)
HTR-Y	400900203BR0043	1 + 1	206	3.4	69.9	24.9	RCS shunt
HTR-Z	400900203CR0044	1 + 1	440	1.6	70.	20.	PT 1 (*)
HTR-CH	400900204BR0131	8 + 8	2.5	0.01	170.	6.	RCS piping1 (**)

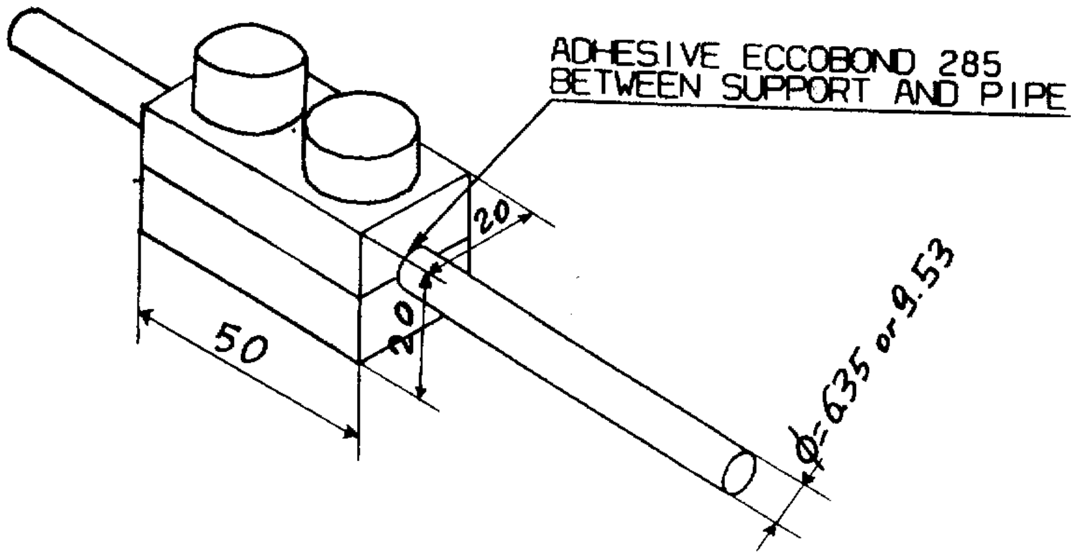
NOTE: (*) main and redundant heaters are installed one over the other with an aluminium foil in between (see para. 5.1).
(**) heaters AI, A2 , M1,M2 on line 3
heaters AI, A2 , I1,I2 on line 4
heaters AI, A2 , F1,F2 on line 7
heaters AI, A2 , F1,F2 on line 8

From Table 5.1: TCS THERMOFOIL HEATERS SUMMARY TABLES

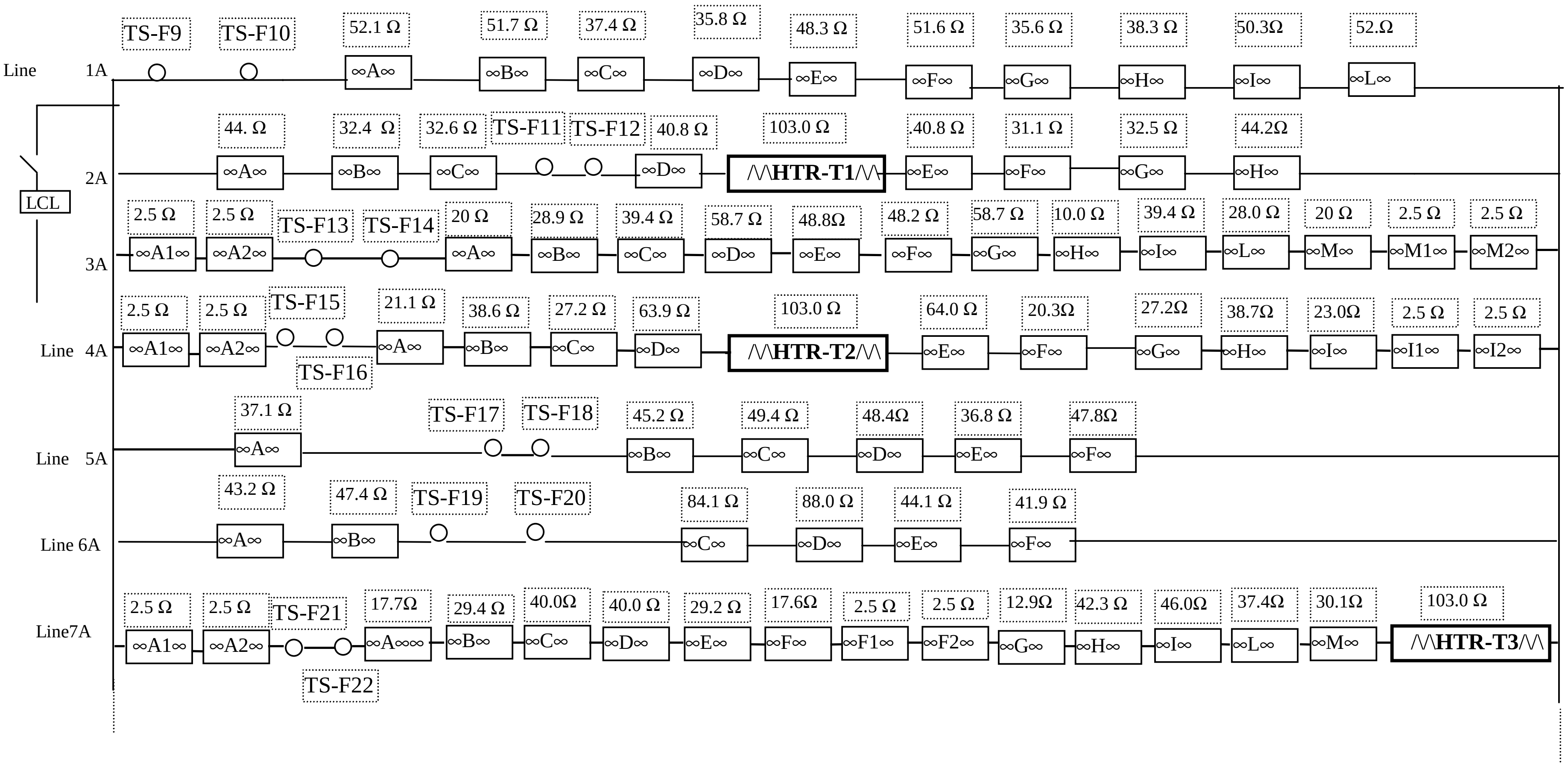
Type	Linear Resistance of each Circuit [Ω/m]	Heater Dimensions		REMARKS (used for:)
		X [**m**]	Y [mm]	
HCL-K	87.9	26.5	asr	LINE 1, 2, 3, 4, 5, 6, 7, 8
HCL-J	69.9	6.5	asr	LINE 2, 4, 5, 7
HCL-H	43.31	3.5	asr	LINE 5
HCL-G	34.94	3.0	asr	LINE 3, 4, 8, 9
HCL-F	28.9	1.5	asr	LINE 7, 11
HCL-D	16.1	1.0	asr	LINE 8, 9
HCL-B	22.96	1.0	asr	LINE 3, 11

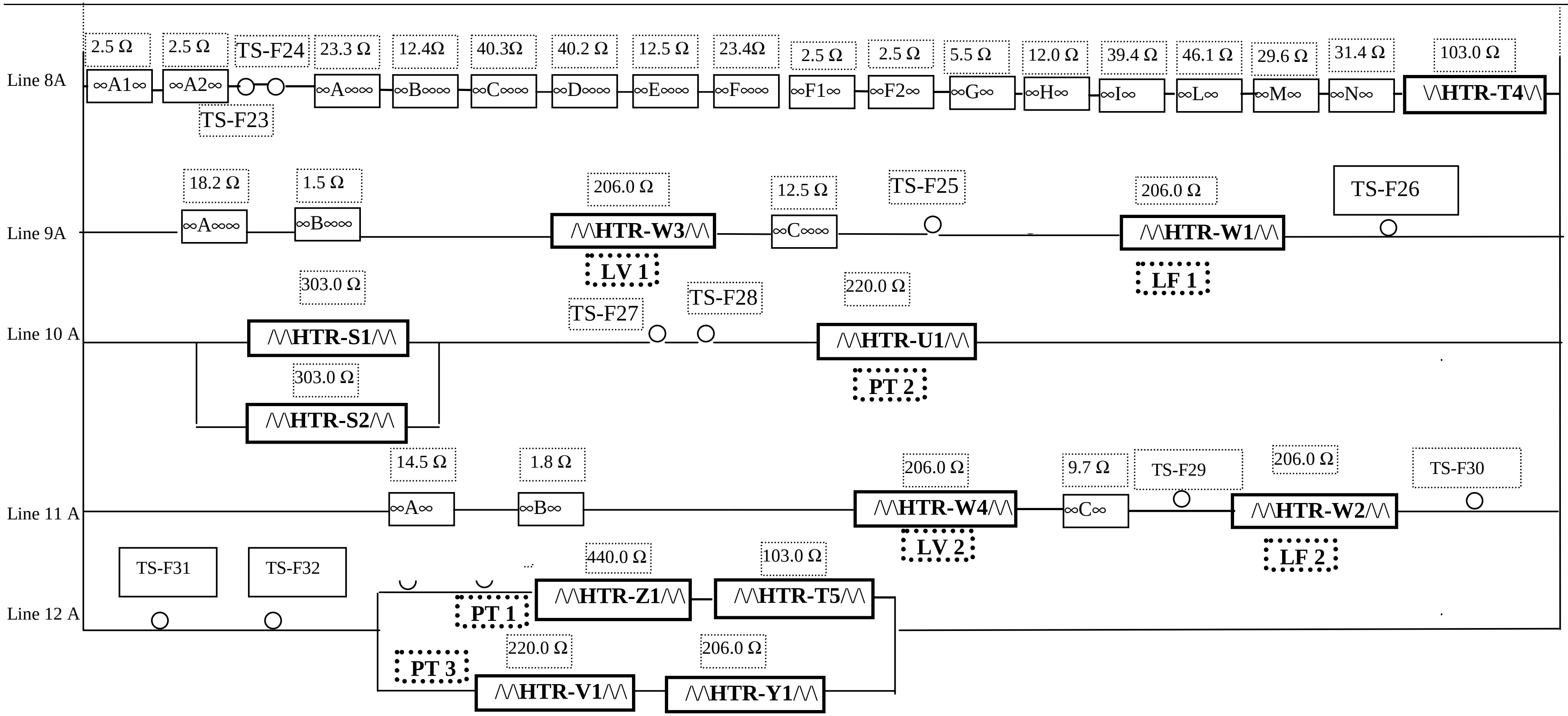
NOTE: (*) main and redundant circuits are together in the same heater

Table 8.1: RCS CLAYBORN HEATERS SUMMARY TABLE (engineering quantities)



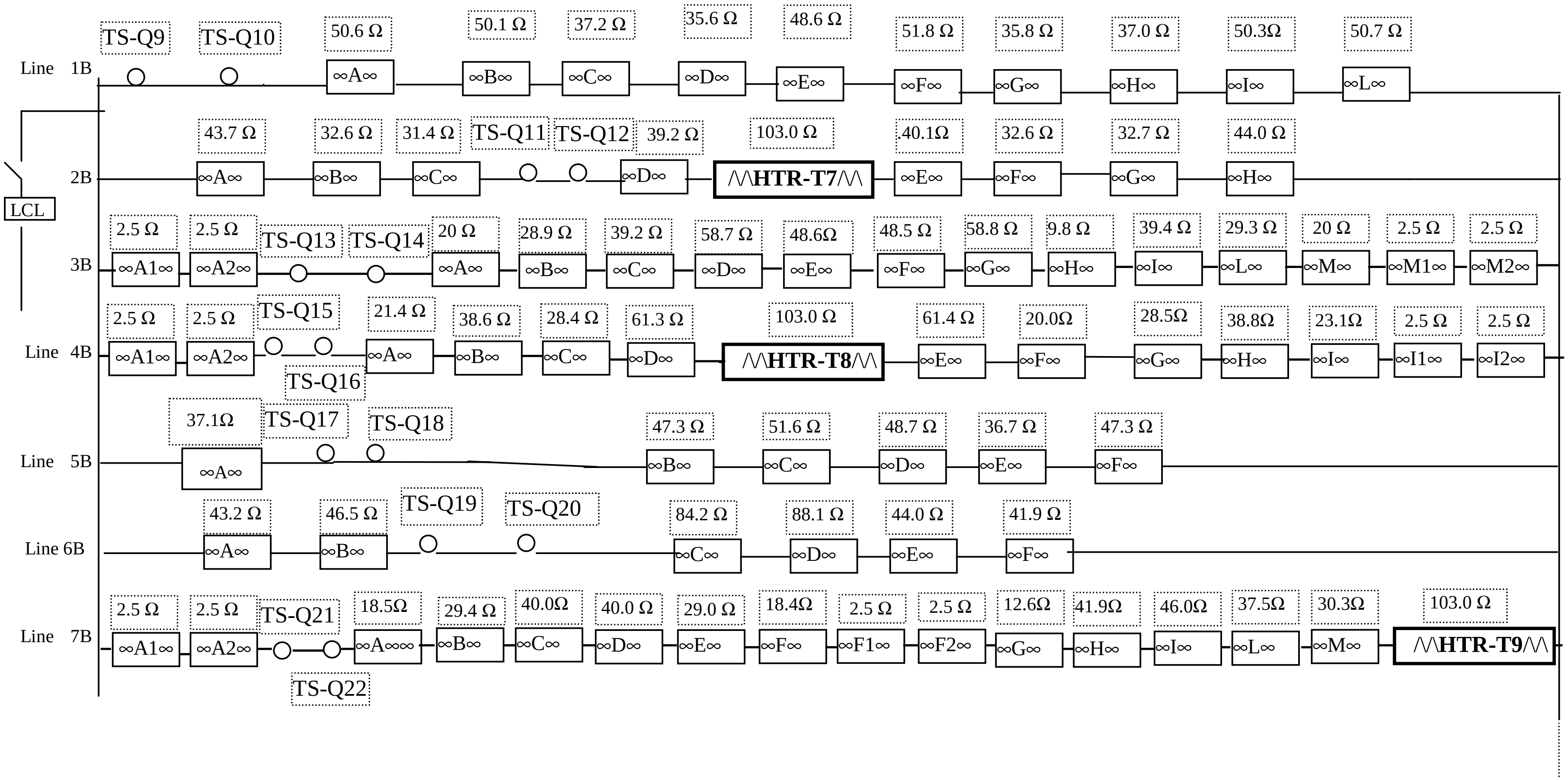
Sketch 8.1: RCS TYPICAL SUPPORT FOR THERMOSTATS

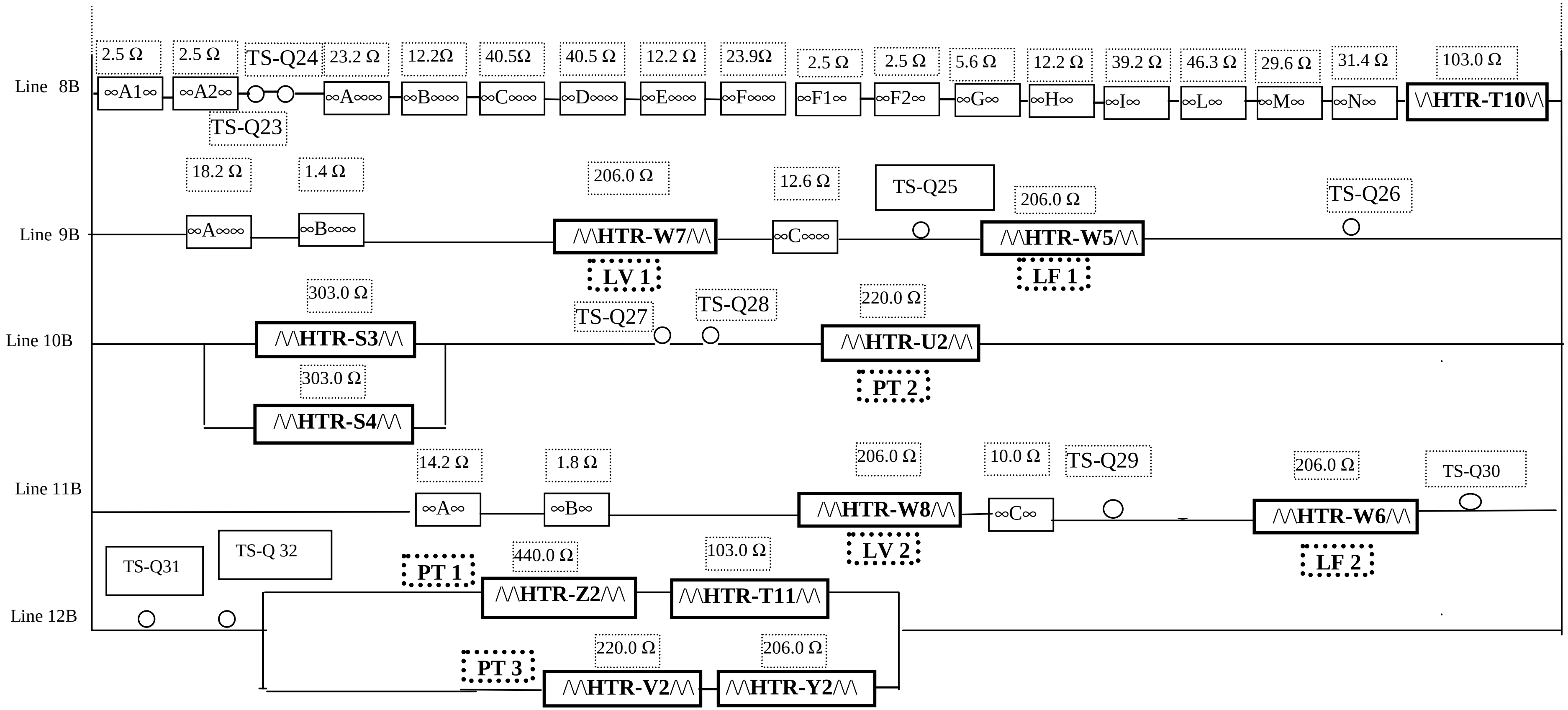

Line 1A
TS-F9 TS-F10 52.1 Ω ∞A∞ 51.7 Ω ∞B∞ 37.4 Ω ∞C∞ 35.8 Ω ∞D∞ 48.3 Ω ∞E∞ 51.6 Ω ∞F∞ 35.6 Ω ∞G∞ 38.3 Ω ∞H∞ 50.3Ω ∞I∞ 52.Ω ∞L∞
LCL
2A
44. Ω ∞A∞ 32.4 Ω ∞B∞ 32.6 Ω ∞C∞ TS-F11 TS-F12 40.8 Ω ∞D∞ 103.0 Ω /\/\HTR-T1/\/\ 40.8 Ω ∞E∞ 31.1 Ω ∞F∞ 32.5 Ω ∞G∞ 44.2Ω ∞H∞
3A
2.5 Ω ∞A1∞ 2.5 Ω ∞A2∞ TS-F13 TS-F14 20 Ω ∞A∞ 28.9 Ω ∞B∞ 39.4 Ω ∞C∞ 58.7 Ω ∞D∞ 48.8Ω ∞E∞ 48.2 Ω ∞F∞ 58.7 Ω ∞G∞ 10.0 Ω ∞H∞ 39.4 Ω ∞I∞ 28.0 Ω ∞L∞ 20 Ω ∞M∞ 2.5 Ω ∞M1∞ 2.5 Ω ∞M2∞
Line 4A
2.5 Ω ∞A1∞ 2.5 Ω ∞A2∞ TS-F15 TS-F16 21.1 Ω ∞A∞ 38.6 Ω ∞B∞ 27.2 Ω ∞C∞ 63.9 Ω ∞D∞ 103.0 Ω /\/\HTR-T2/\/\ 64.0 Ω ∞E∞ 20.3Ω ∞F∞ 27.2Ω ∞G∞ 38.7Ω ∞H∞ 23.0Ω ∞I∞ 2.5 Ω ∞I1∞ 2.5 Ω ∞I2∞
Line 5A
37.1 Ω ∞A∞ TS-F17 TS-F18 45.2 Ω ∞B∞ 49.4 Ω ∞C∞ 48.4Ω ∞D∞ 36.8 Ω ∞E∞ 47.8Ω ∞F∞
Line 6A
43.2 Ω ∞A∞ 47.4 Ω ∞B∞ TS-F19 TS-F20 84.1 Ω ∞C∞ 88.0 Ω ∞D∞ 44.1 Ω ∞E∞ 41.9 Ω ∞F∞
Line7A
2.5 Ω ∞A1∞ 2.5 Ω ∞A2∞ TS-F21 TS-F22 17.7Ω ∞A∞∞ 29.4 Ω ∞B∞ 40.0Ω ∞C∞ 40.0 Ω ∞D∞ 29.2 Ω ∞E∞ 17.6Ω ∞F∞ 2.5 Ω ∞F1∞ 2.5 Ω ∞F2∞ 12.9Ω ∞G∞ 42.3 Ω ∞H∞ 46.0Ω ∞I∞ 37.4Ω ∞L∞ 30.1Ω ∞M∞ 103.0 Ω /\/\HTR-T3/\/\



NOTES: 1) TS-F31 and TS-F32 must be physically installed on PT 3.
2) Resistance values measured after installation

Scheme 8.1: RCS ASSEMBLY HEATERS AND THERMOSTATS ELECTRICAL NOMINAL CONFIGURATION

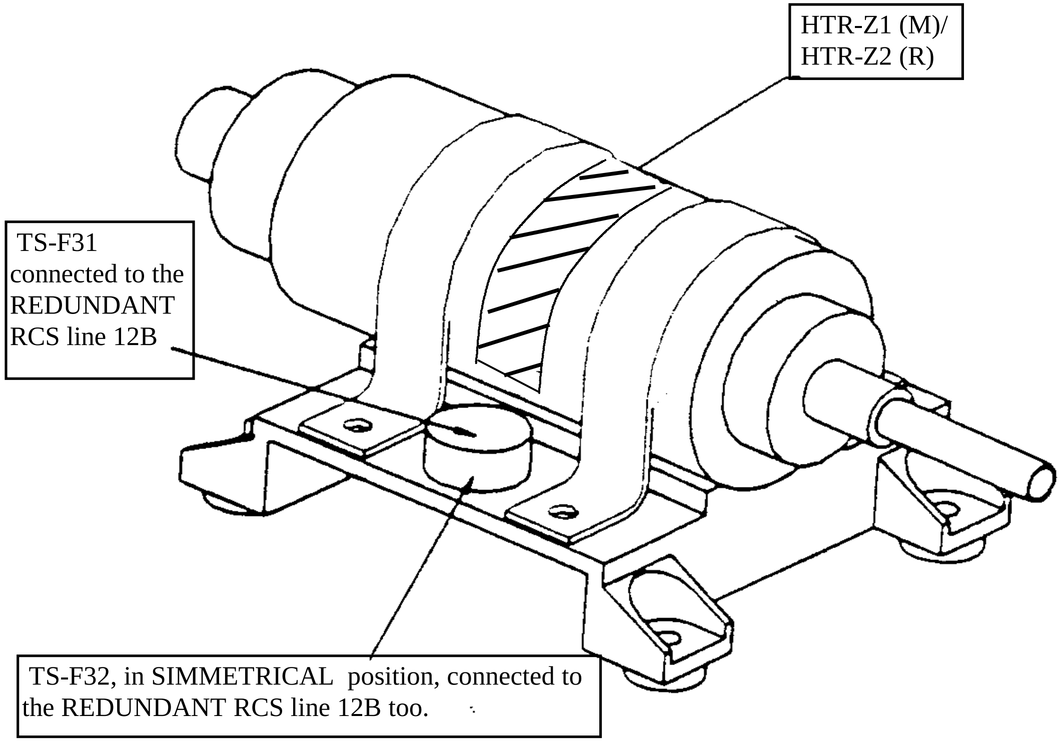

LCL
Line 1B
TS-Q9
TS-Q10
50.6 Ω ∞A∞
50.1 Ω ∞B∞
37.2 Ω ∞C∞
35.6 Ω ∞D∞
48.6 Ω ∞E∞
51.8 Ω ∞F∞
35.8 Ω ∞G∞
37.0 Ω ∞H∞
50.3Ω ∞I∞
50.7 Ω ∞L∞
2B
43.7 Ω ∞A∞
32.6 Ω ∞B∞
31.4 Ω ∞C∞
TS-Q11
TS-Q12
39.2 Ω ∞D∞
103.0 Ω /\/\HTR-T7/\/\
.40.1Ω ∞E∞
32.6 Ω ∞F∞
32.7 Ω ∞G∞
44.0 Ω ∞H∞
3B
2.5 Ω ∞A1∞
2.5 Ω ∞A2∞
TS-Q13
TS-Q14
20 Ω ∞A∞
28.9 Ω ∞B∞
39.2 Ω ∞C∞
58.7 Ω ∞D∞
48.6Ω ∞E∞
48.5 Ω ∞F∞
58.8 Ω ∞G∞
9.8 Ω ∞H∞
39.4 Ω ∞I∞
29.3 Ω ∞L∞
20 Ω ∞M∞
2.5 Ω ∞M1∞
2.5 Ω ∞M2∞
Line 4B
2.5 Ω ∞A1∞
2.5 Ω ∞A2∞
TS-Q15
TS-Q16
21.4 Ω ∞A∞
38.6 Ω ∞B∞
28.4 Ω ∞C∞
61.3 Ω ∞D∞
103.0 Ω /\/\HTR-T8/\/\
61.4 Ω ∞E∞
20.0Ω ∞F∞
28.5Ω ∞G∞
38.8Ω ∞H∞
23.1Ω ∞I∞
2.5 Ω ∞I1∞
2.5 Ω ∞I2∞
Line 5B
37.1Ω ∞A∞
TS-Q17
TS-Q18
47.3 Ω ∞B∞
51.6 Ω ∞C∞
48.7 Ω ∞D∞
36.7 Ω ∞E∞
47.3 Ω ∞F∞
Line 6B
43.2 Ω ∞A∞
46.5 Ω ∞B∞
TS-Q19
TS-Q20
84.2 Ω ∞C∞
88.1 Ω ∞D∞
44.0 Ω ∞E∞
41.9 Ω ∞F∞
Line 7B
2.5 Ω ∞A1∞
2.5 Ω ∞A2∞
TS-Q21
TS-Q22
18.5Ω ∞A∞∞
29.4 Ω ∞B∞
40.0Ω ∞C∞
40.0 Ω ∞D∞
29.0 Ω ∞E∞
18.4Ω ∞F∞
2.5 Ω ∞F1∞
2.5 Ω ∞F2∞
12.6Ω ∞G∞
41.9Ω ∞H∞
46.0Ω ∞I∞
37.5Ω ∞L∞
30.3Ω ∞M∞
103.0 Ω /\/\HTR-T9/\/\



NOTES: 1) TS-Q31 and TS-Q32 must be physically installed on PT 1.
2) Resistance values measured after installation

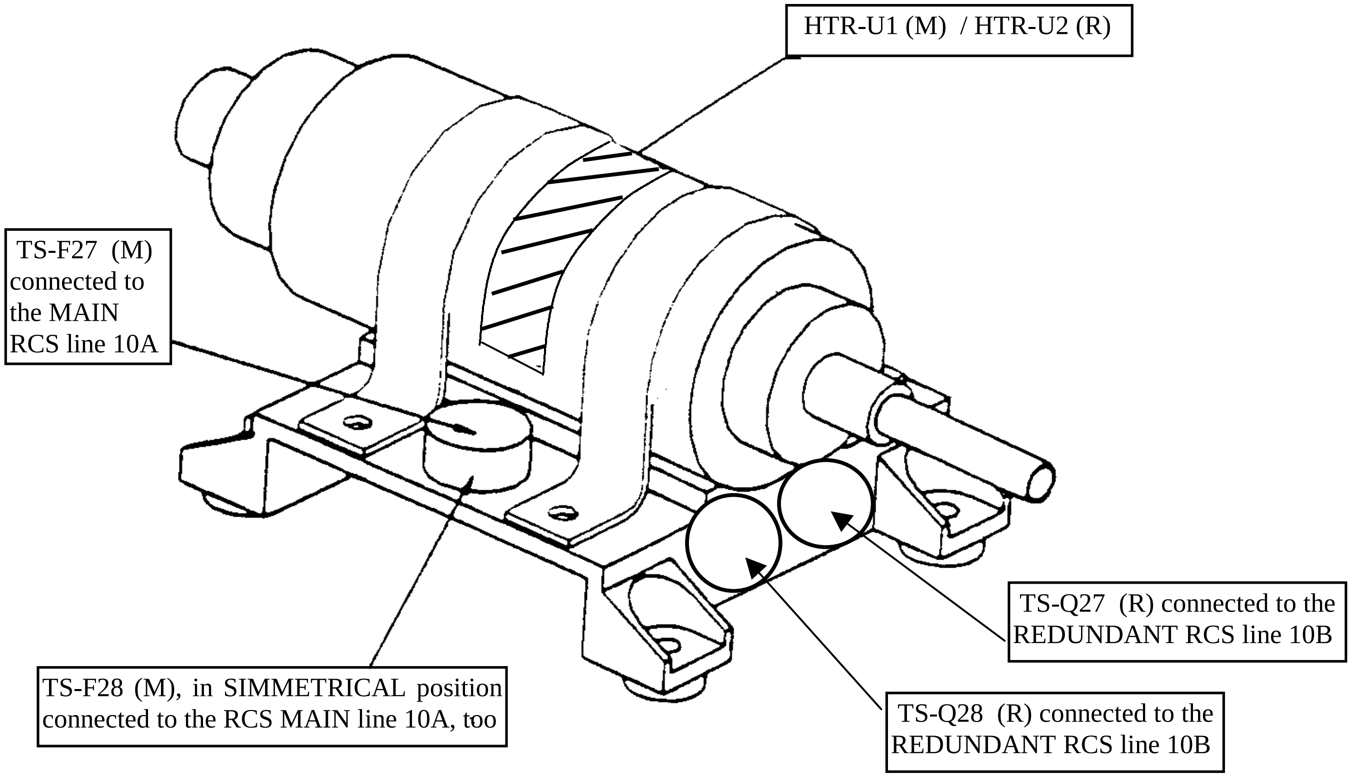
Scheme 8.2: RCS ASSEMBLY HEATERS AND THERMOSTATS ELECTRICAL REDUNDANT CONFIGURATION

8.1 RCS LINES HEATERS AND THERMOSTATS LOCATION



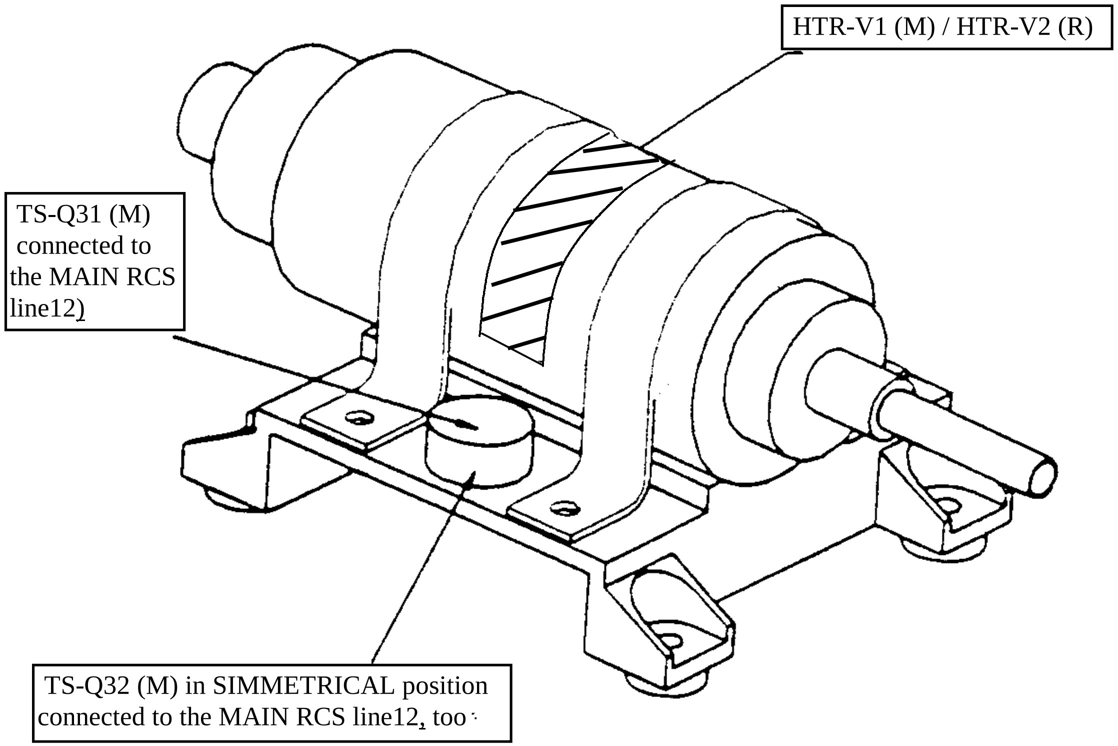
NOTE: *REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

FIGURE 8.1 (a): HEATERS AND THERMOSTATS INSTALLATION ON PT-01



NOTE: *REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

FIGURE 8.1 (b): HEATERS AND THERMOSTATS INSTALLATION ON PT-02



***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*

FIGURE 8.1 (c): HEATERS AND THERMOSTATS INSTALLATION ON PT-03

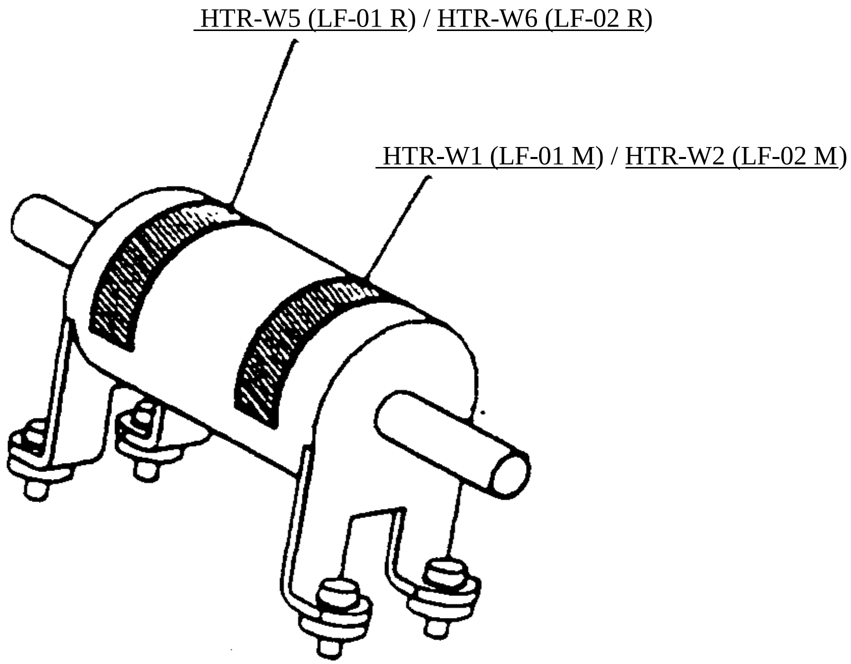


FIGURE 8.2: HEATERS INSTALLATION ON LF-01 AND LF-02

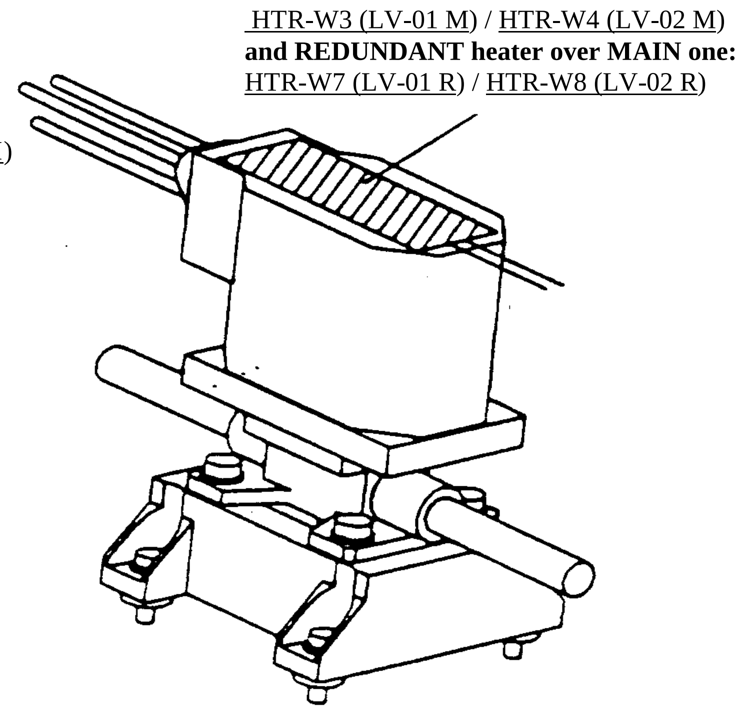
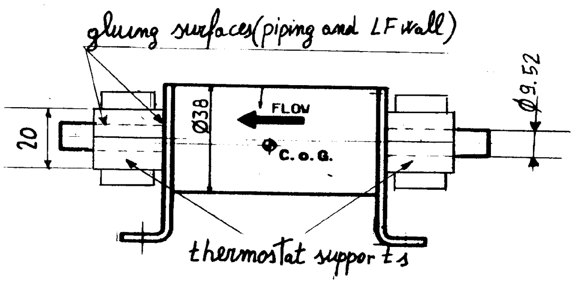


FIGURE 8.3: HEATERS INSTALLATION ON LV-01 AND LV-02

***NOTE**: REDUNDANT HEATER IS INSTALLED OVER MAIN WITH THE INTERPOSITION OF AN ALUMINIUM FOIL (see para 5.1.1)*



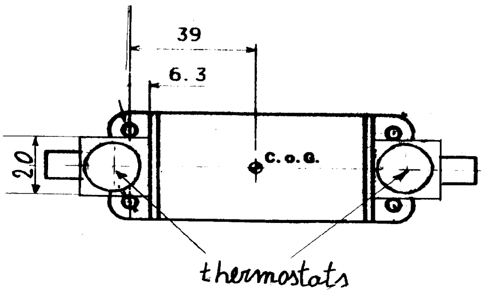


FIGURE 8.3(a): THERMOSTATS INSTALLATION ON LF-01 AND LF-02

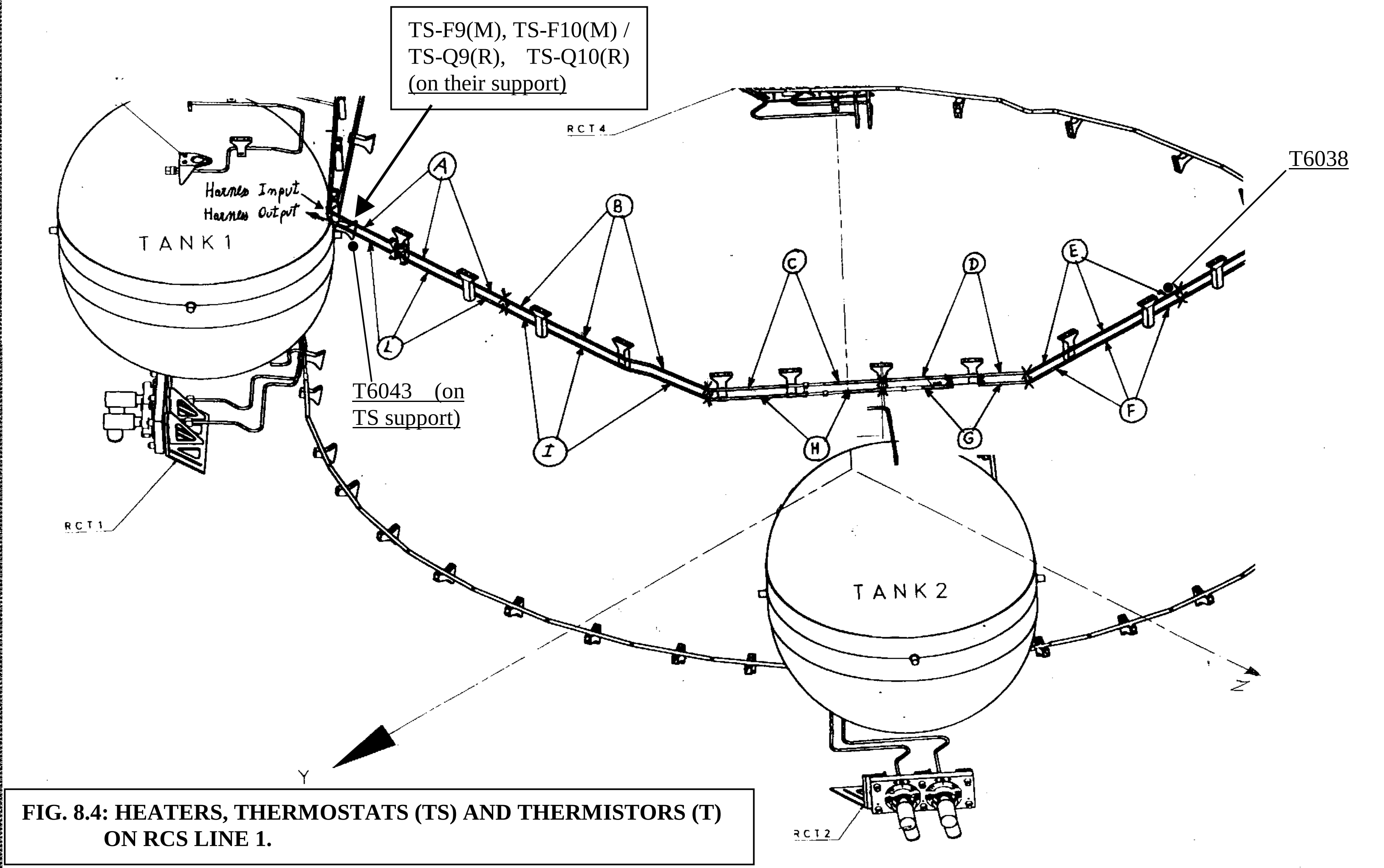


FIG. 8.4: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 1.

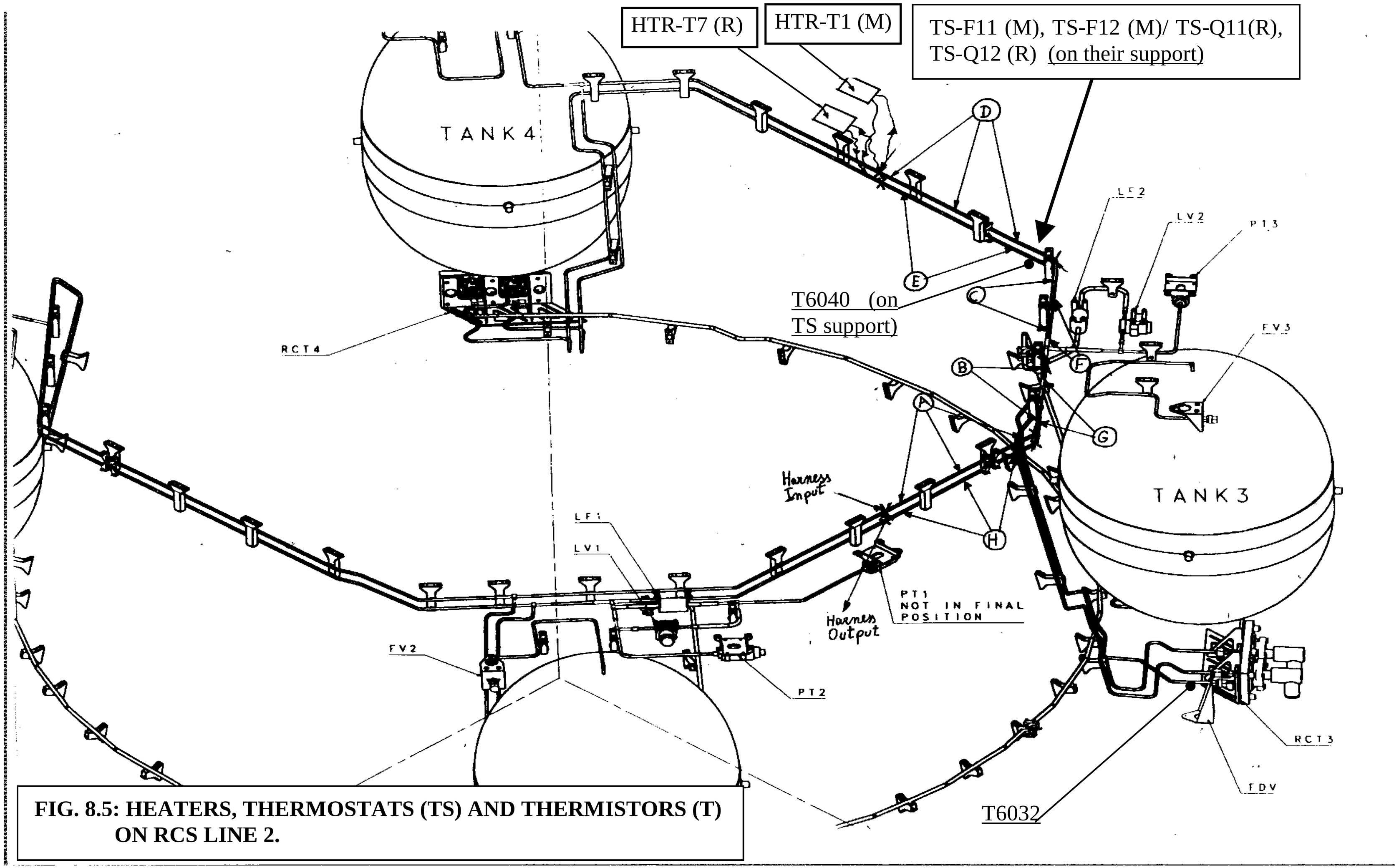


FIG. 8.5: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 2.

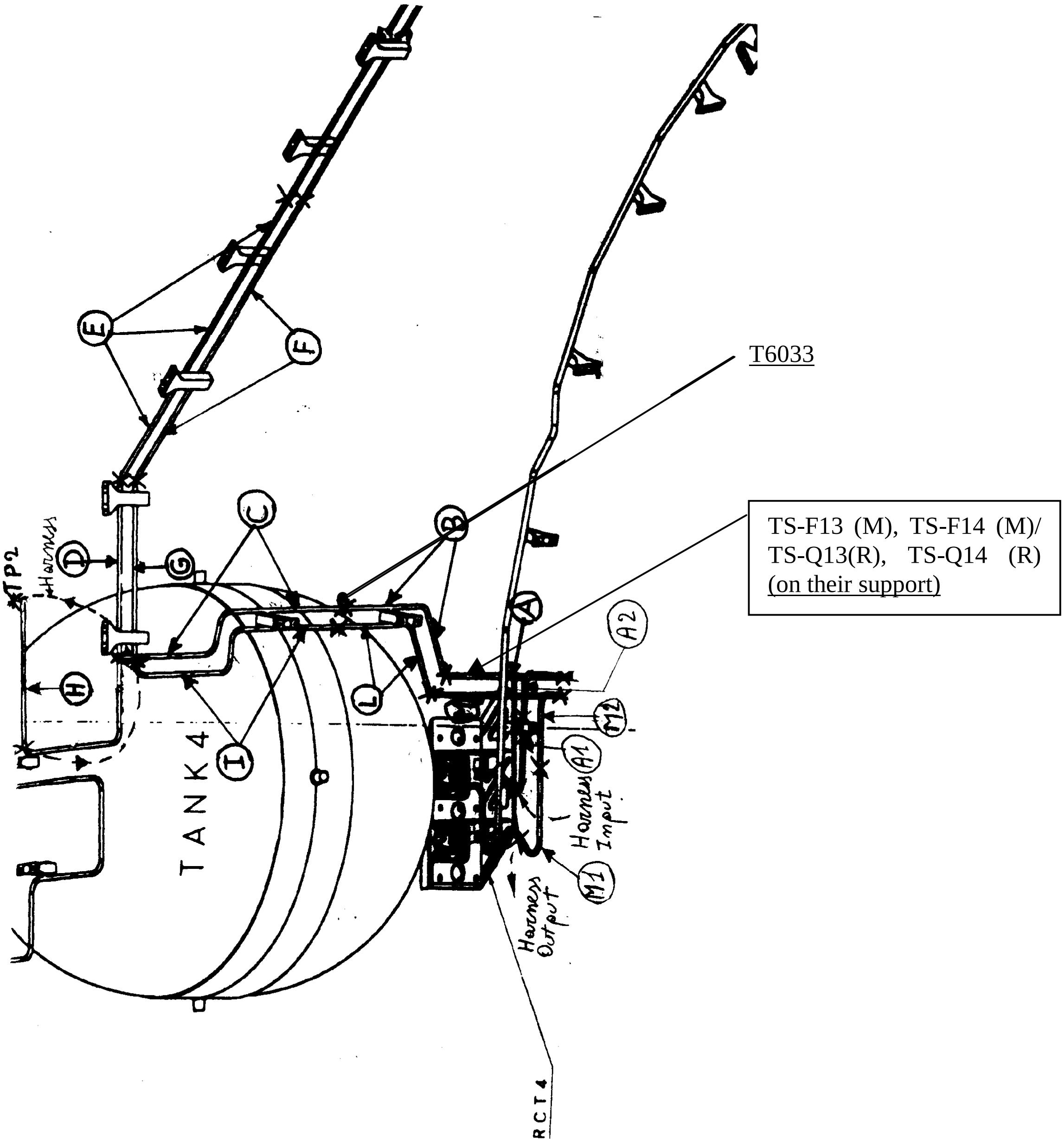


FIG. 8.6: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 3.

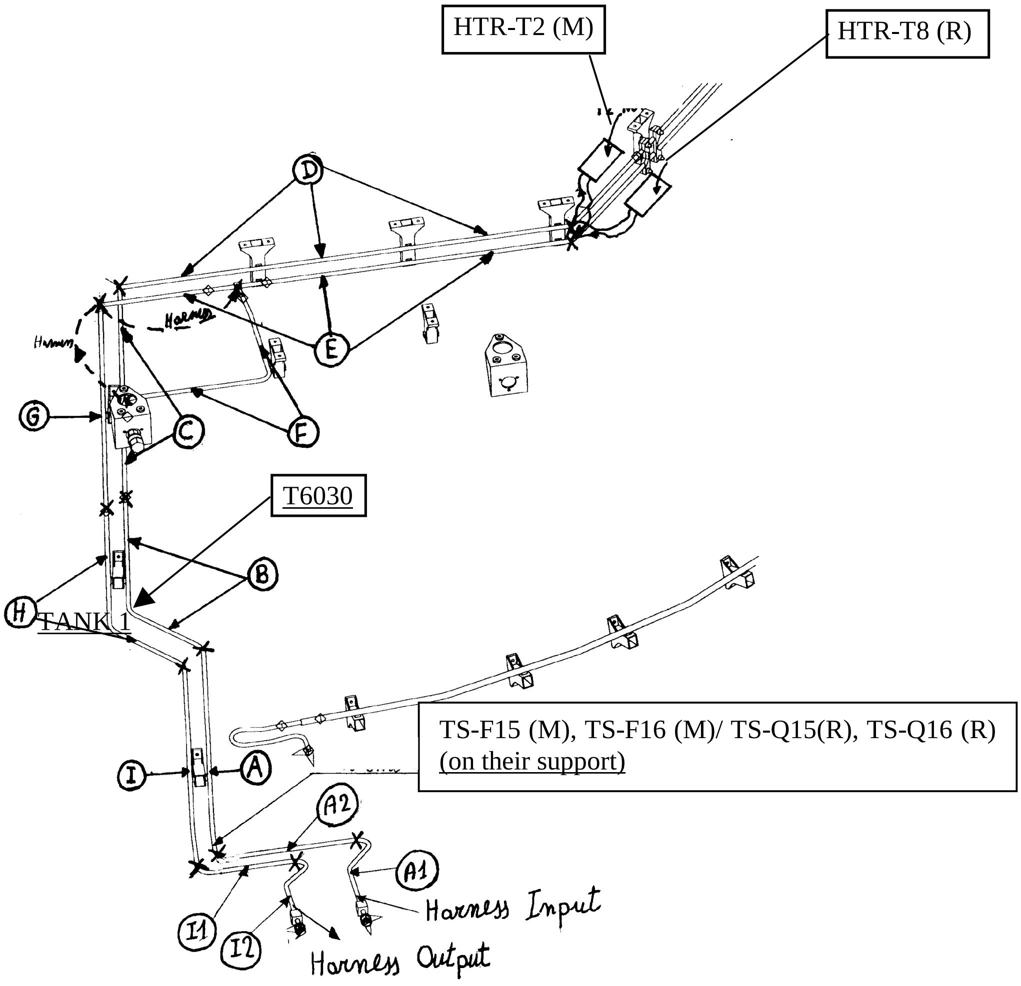


FIG. 8.7: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 4.

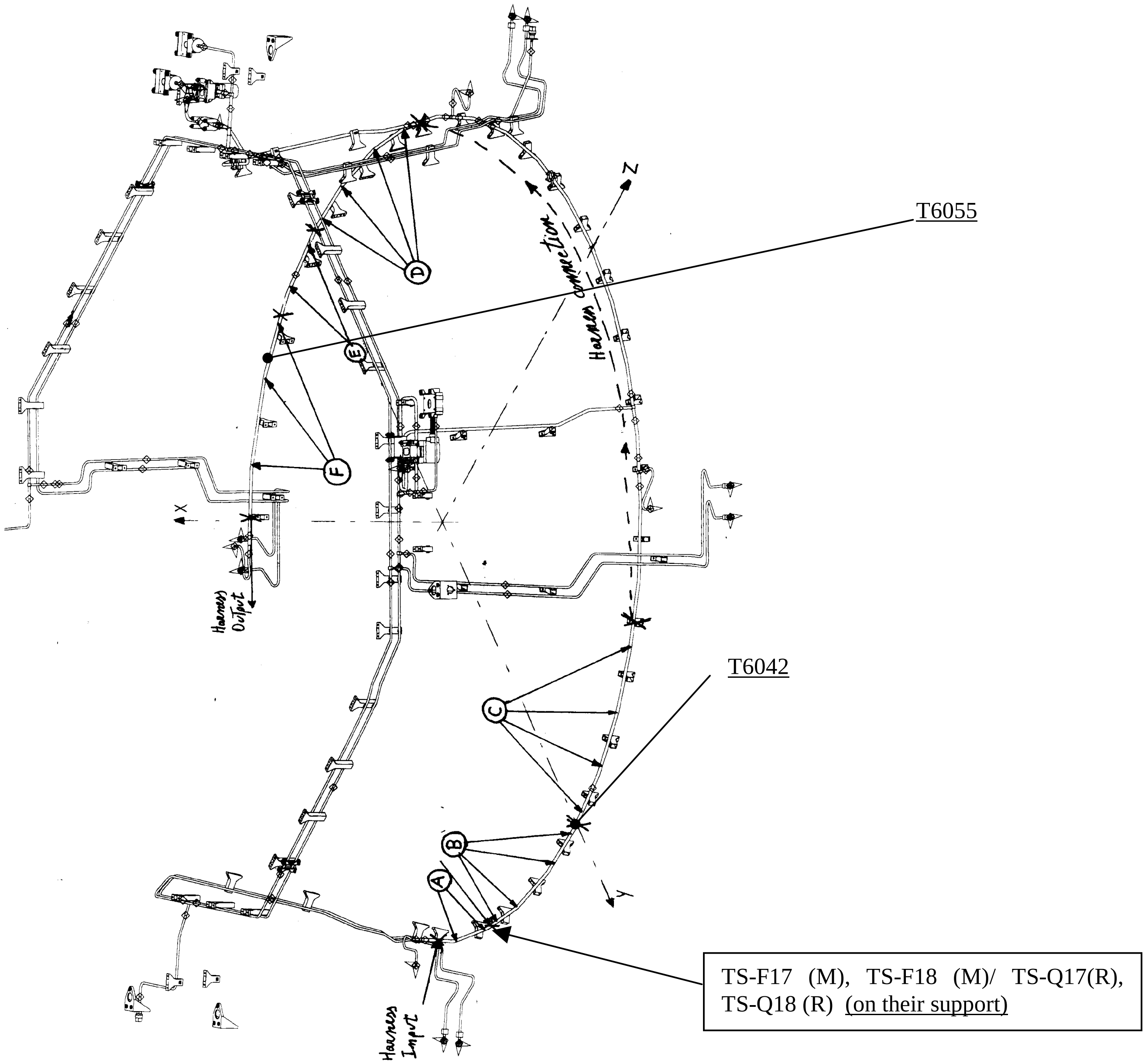


FIG. 8.8: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 5.

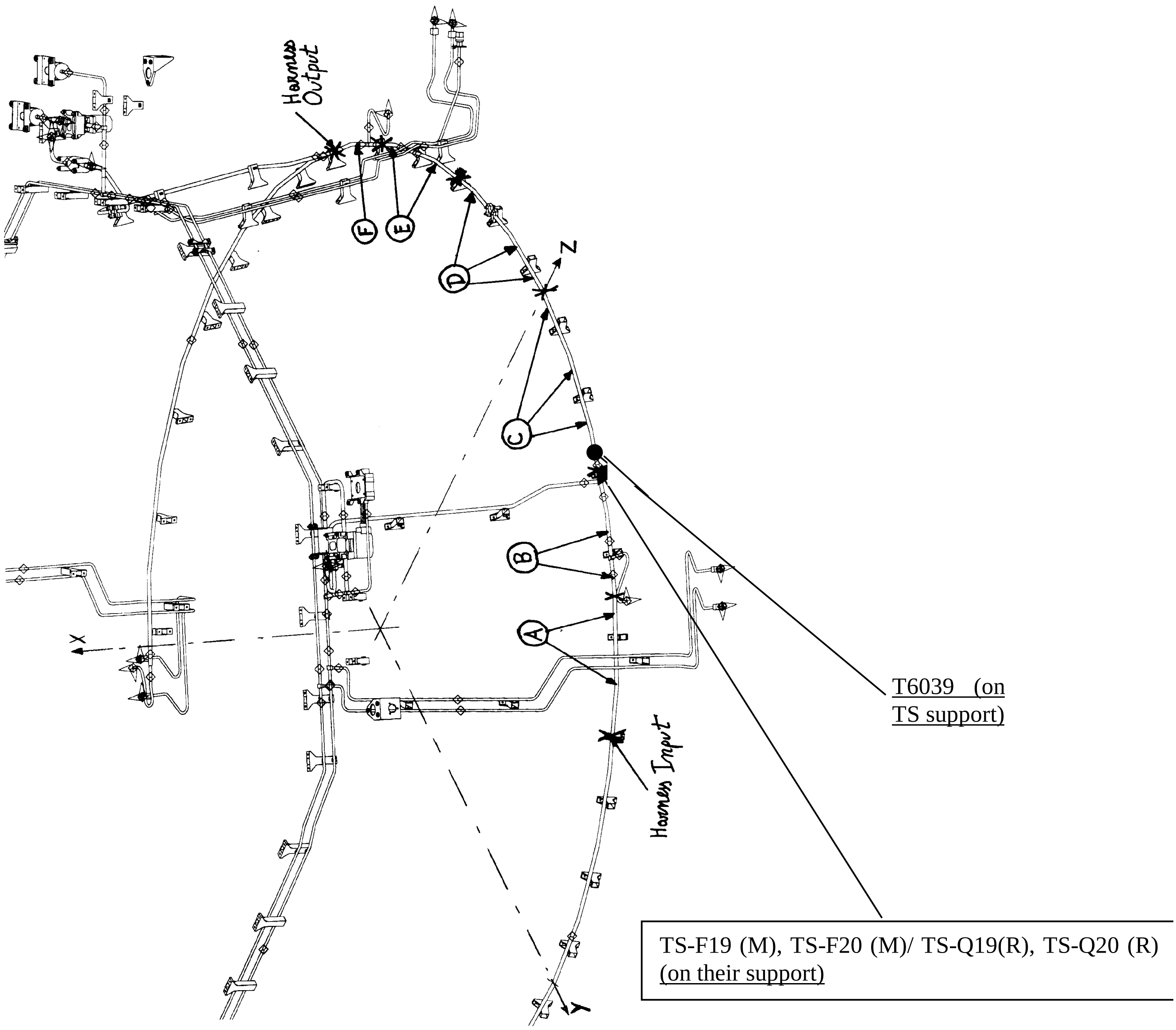


FIG. 8.9: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 6.

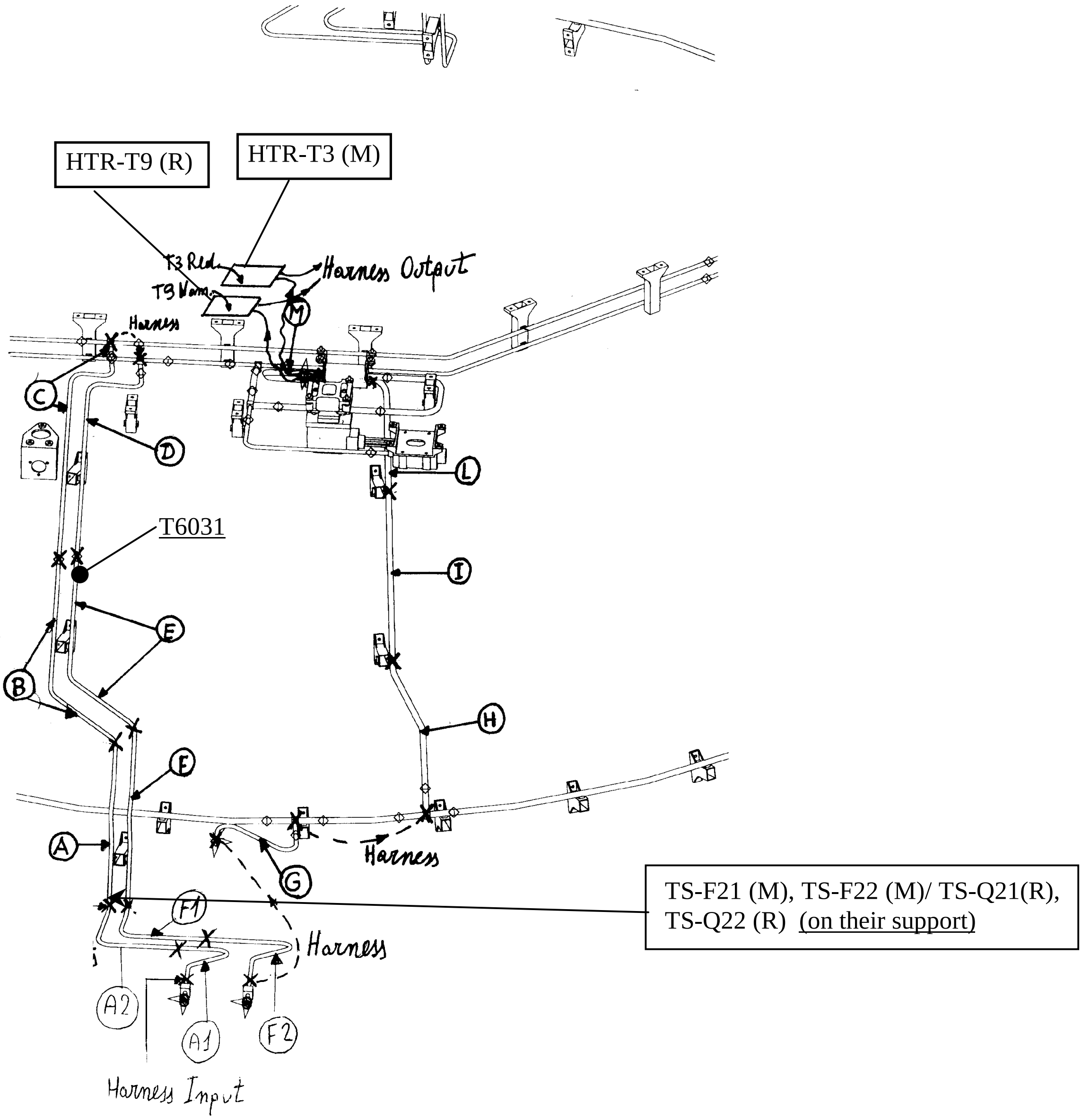


FIG. 8.10: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 7.

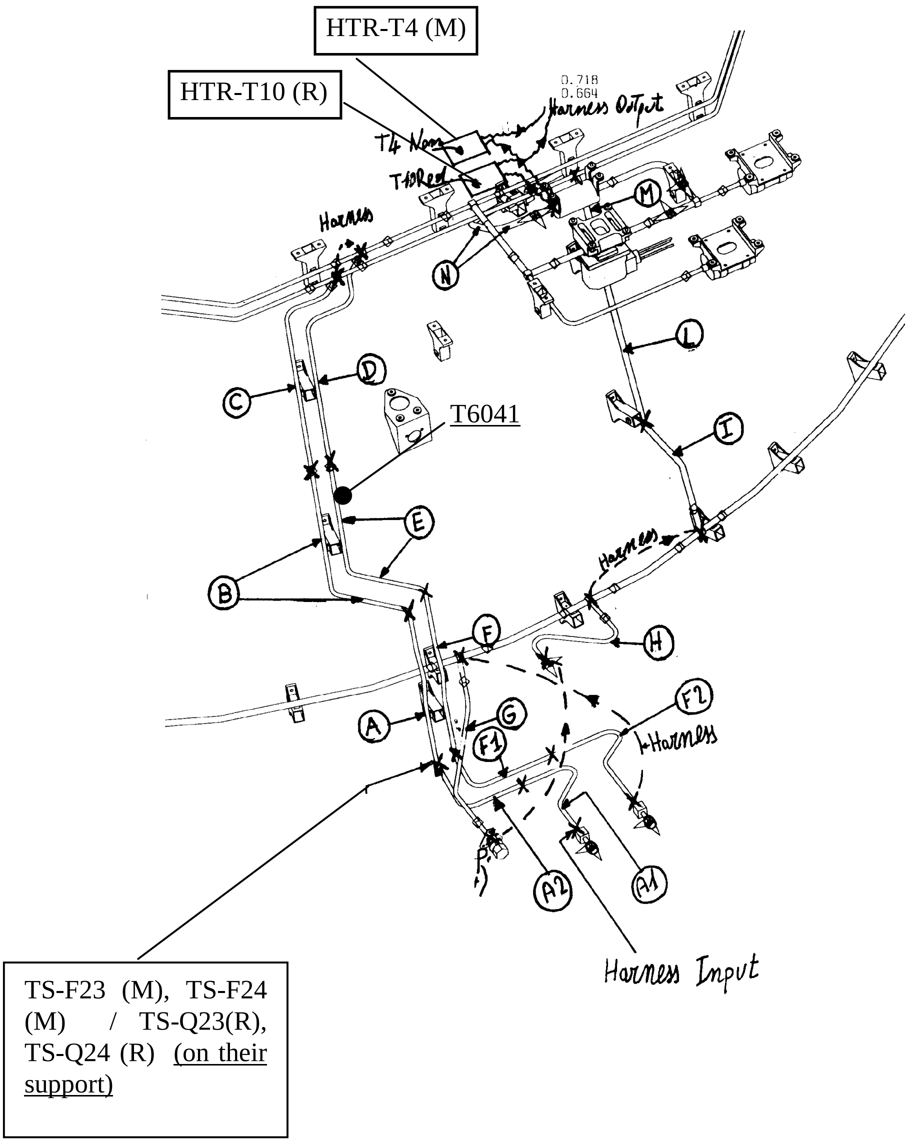
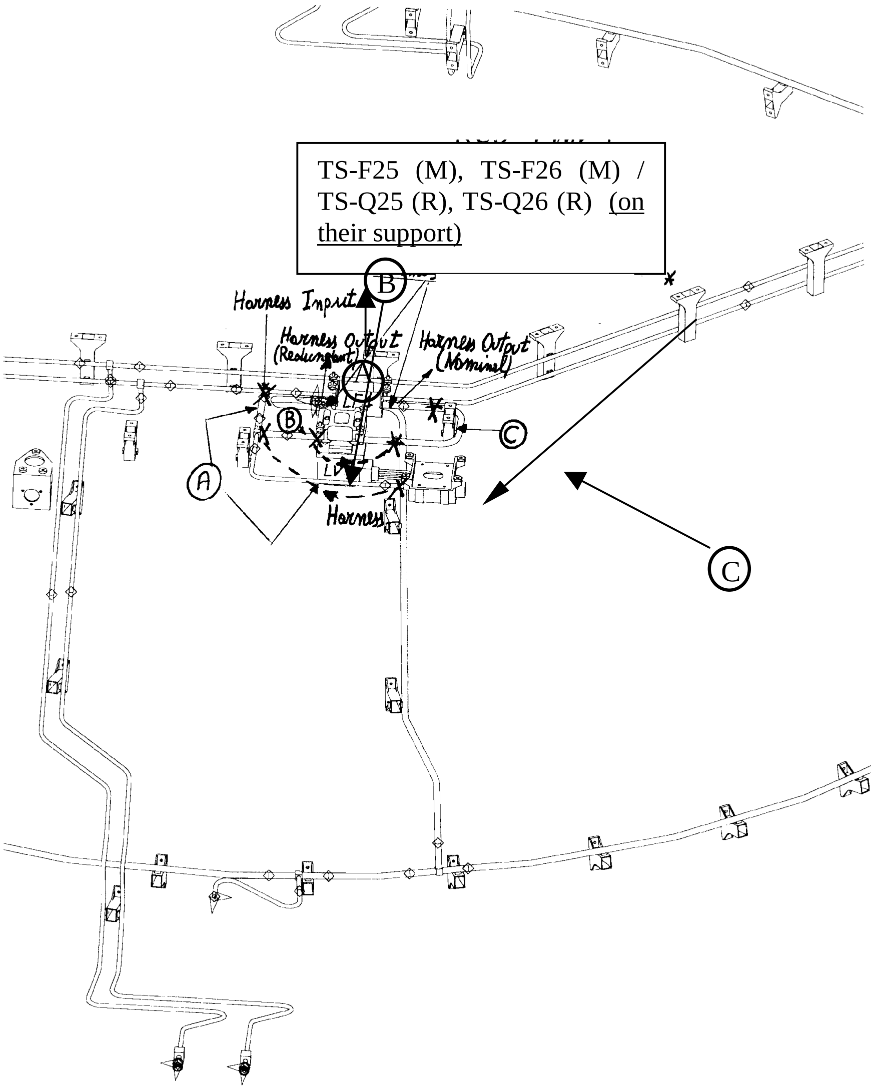
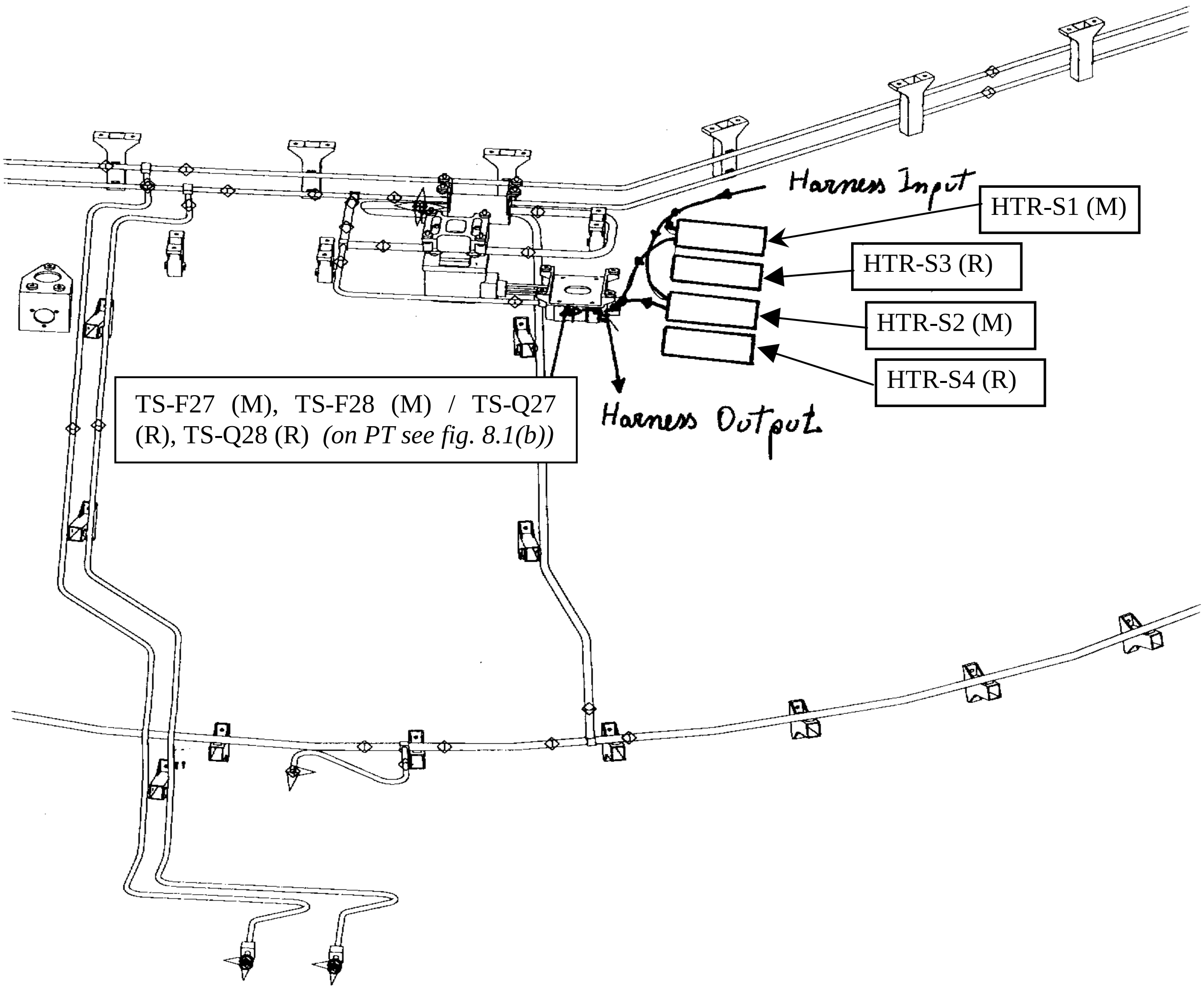


FIG. 8.11: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 8.



NOTE: for LF1 AND LV1 see fig. 8.2, 8.3 for HEATERS and fig. 4.2 (e), 4.2 (d), for THERMISTORS

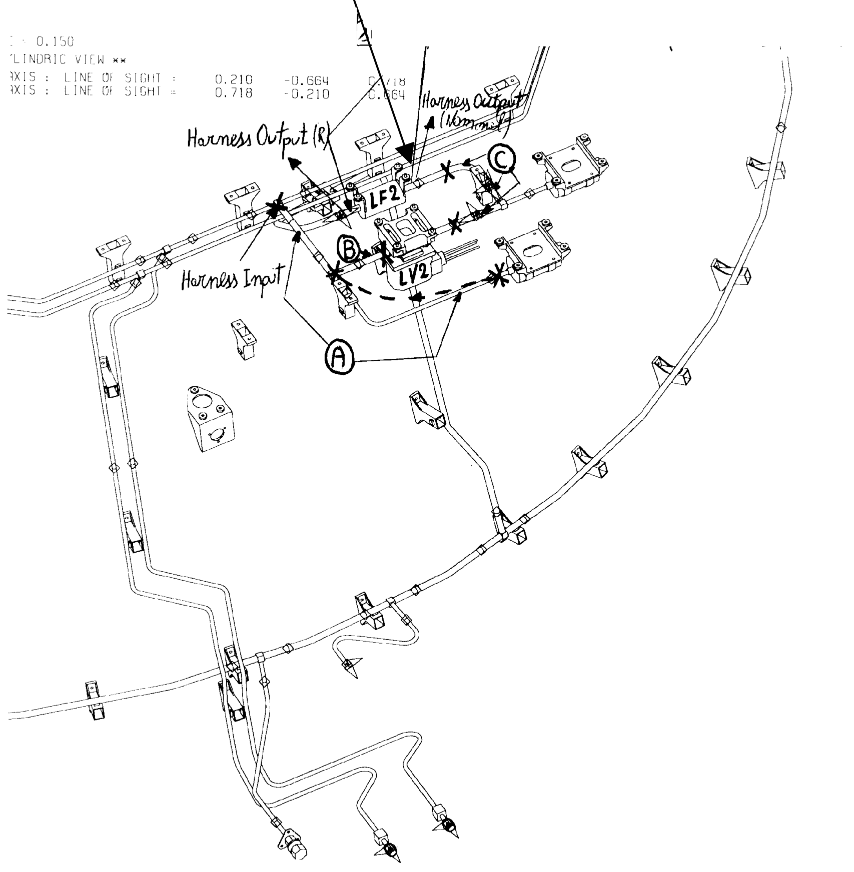
FIG. 8.12: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 9.



NOTE: for install. on PT2 see fig. 8.1 (b) for HEATERS and THERMOSTATS; fig. 4.2 (c) for THERMISTORS;

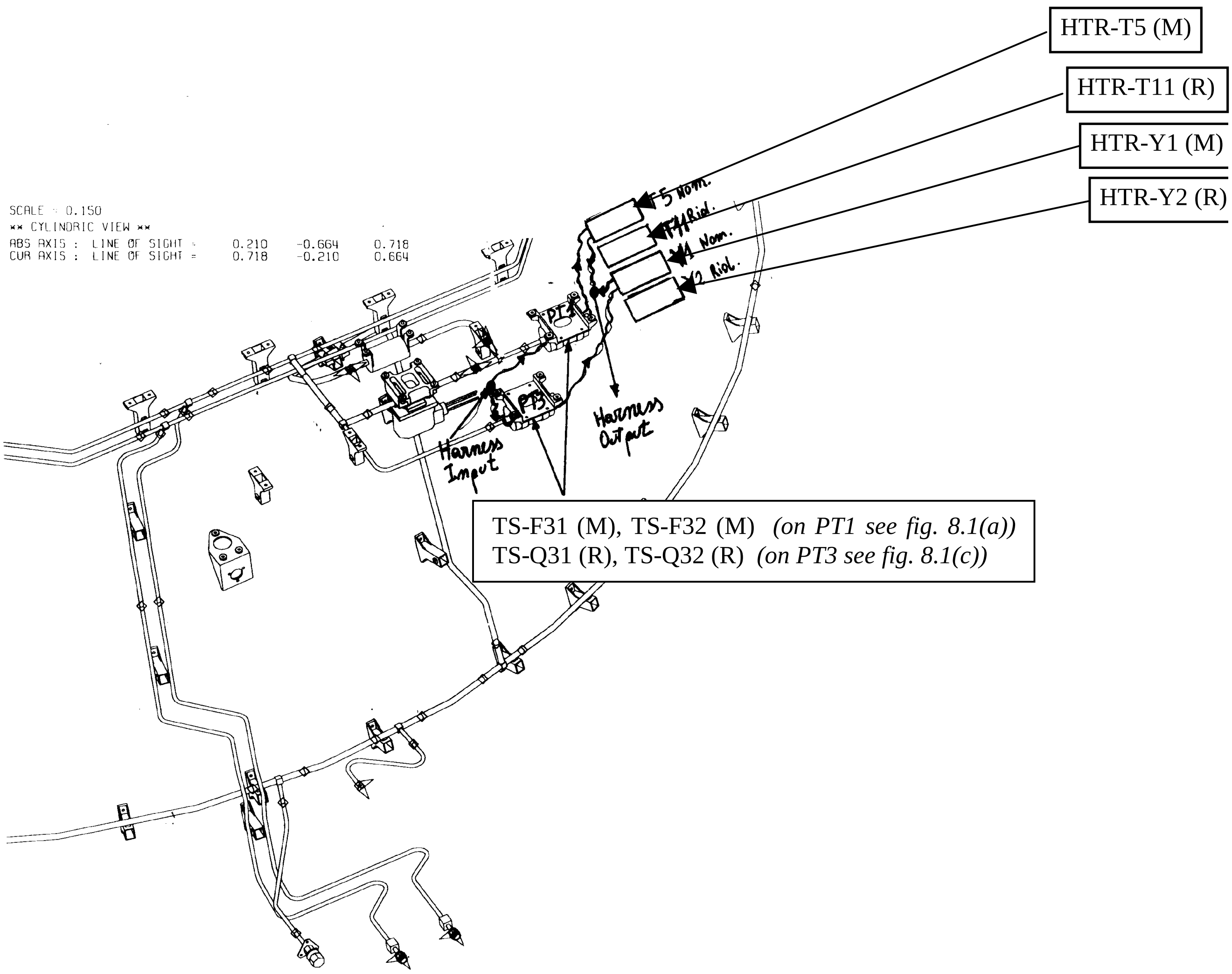
FIG. 8.13: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 10.

TS-F29 (M), TS-F30 (M) / TS-Q29 (R), TS-Q30 (R) <u>(on their support)</u>



NOTE: for LF2 AND LV2 see fig. 8.2, 8.3 for HEATERS and fig. 4.2 (e), 4.2 (d), for THERMISTORS

FIG. 8.14: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 11.



NOTE: for install. on PT1 & PT3 see fig. 8.1 (a) & (c) for HEATERS and THERMOSTATS; fig. 4.2 (c) for THERMISTORS;

FIG. 8.15: HEATERS, THERMOSTATS (TS) AND THERMISTORS (T) ON RCS LINE 12.

9. THERMISTORS HARDWARE MATRIX

In the following table the TCS thermistors hardware matrix is reported.

TYPE	ALS PART NUMBER	Name (supplier P. / N.)	Resis. @ 25.°C	Supplier	PROVIDED by:	INSTALLED by:	CONNECTED to:	TOTAL ENGINEER. QUANTITY
TH-A	--	YSI 44908	10. KOhms	YELLOW SPRING	CASA	ALENIA	SVM RTU	68
TH-B	400601454BSGAI002	G10K4DX	10. KOhms	BETATHERM	ALENIA	ALENIA	PLM RTU	19
TH-C	400601453BSGAI002	G4.5K7DX	4.5 KOhms	BETATHERM	ALENIA	ALENIA	PLM RTU	8
TH-D	400601452BSGAI002	G0.5K1DX	0.5 KOhms	BETATHERM	ALENIA	ALENIA	PLM RTU	4
TH-E	--	PT 500	--	--	--	--	--	0
TH-								
TH-								

10. HEATERS HARDWARE MATRIX

In the following tables the TCS heaters hardware matrix is reported.

TYPE	ALS / CASA PART NUMBER	Main And Redundant Quantity (M+R)	HEATER Resistance [Ω]	HEATER Dimensions X [mm]	HEATER Dimensions Y [mm]	Supplier	PROVIDED by:	INSTALLED by:	S/C module	TOTAL ENGINEER. QUANTITY
HTR-A	400900216BR0013	1 + 1	39	190.	40.	RICA	ALENIA	ALENIA	PLM	2
HTR-B	400900216BR0014	1 + 1	88	100.	40.	RICA	ALENIA	ALENIA	PLM	2
HTR-C	400900216BR0015	2 + 2	64	120.	40.	RICA	ALENIA	ALENIA	PLM	4
HTR-D	400900216BR0016	2 + 2	35	170.	50.	RICA	ALENIA	ALENIA	PLM	4
HTR-E	400900216BR0017	7 + 7	176	60.	30.	RICA	ALENIA	ALENIA	PLM	14
HTR-F	400900216BR0018	2 + 2	24.5	295.	55.	RICA	ALENIA	ALENIA	PLM	4
HTR-G	400900216BR0019	12 + 12	50	500.	20.	RICA	ALENIA	ALENIA	PLM	24
HTR-H	400900216BR0020	2 + 2	47	160.	40.	RICA	ALENIA	ALENIA	PLM	4
HTR-I	400900216BR0087	2 + 2	470	50.	12.	RICA	ALENIA	ALENIA	SVM	4
HTR-J	400900216BR0001	4 + 4	134	450.	10.	RICA	ALENIA	SAFT	SVM	8
HTR-K	400900203CR0033	4 + 4	140+140 (#)	120.	35.	RICA	CASA	ALENIA	SVM	8
HTR-L	400900203CR0034	4 + 4	520+520 (#)	45.	22.	RICA	CASA	ALENIA	SVM	8
HTR-M	400900203CR0032	2 + 2	95	160.	30.	RICA	CASA	ALENIA	SVM	4
HTR-N	400900203CR0035	8 + 8	350	380.	32.	RICA	CASA	ALENIA	SVM	16
HTR-P	400900203CR0036	12 + 12	610	120.	10.	RICA	CASA	ALENIA	SVM	24
HTR-Q	400900216BR0053	8 + 8	350	45.	16.	RICA	ALENIA	ALENIA	SVM	16

NOTE: (#) both nominal and redundant heaters have two separate circuits.

TYPE	ALS PART NUMBER	Main And Redundant Quantity (M+R)	HEATER Resistance [Ω]	HEATER Dimensions		Supplier	PROVIDED by:	INSTALLED by:	S/C module	TOTAL ENGINEER. QUANTITY
				X [mm]	Y [mm]					
HTR-R	400900203CR0038	2 + 2	176	126.	23.	RICA	CASA	ALENIA	SVM	4(*)
HTR-S	400900203CR0042	2 + 2	303	75.2	24.6	RICA	CASA	ALENIA	SVM	4
HTR-T	400900203CR0041	6 + 6	103	125.7	22.9	RICA	CASA	ALENIA	SVM	12
HTR-U	400900203CR0040	1 + 1	220	50.	19.8	RICA	CASA	ALENIA	SVM	2
HTR-V	400900203BR0040	1 + 1	220	50.	19.8	RICA	ALENIA	ALENIA	SVM	2
HTR-W	400900203CR0043	4 + 4	206	69.9	24.9	RICA	CASA	ALENIA	SVM	8
HTR-Y	400900203BR0043	1 + 1	206	69.9	24.9	RICA	ALENIA	ALENIA	SVM	2
HTR-Z	400900203CR0044	1 + 1	440	70.	20.	RICA	CASA	ALENIA	SVM	2
HTR-X	400900203CR0037	4 + 4	350	50.	20.	RICA	CASA	ALENIA	SVM	8
HTR-CH	400900203BR0131	8+8	2.5	170.	6.	RICA	ALENIA	ALENIA	SVM	16
HTR-a	400900215BR0128	4+4	42	287.	33.	RICA	ALENIA	LABEN	PLM	3
HTR-b	400900215BR0126	1+1	47	137.	42.	RICA	ALENIA	LABEN	PLM	2
HTR-c	400900215BR0127	1+1	47	137.	42.	RICA	ALENIA	LABEN	PLM	2
HTR-d	400900215BR0129	4+4	140//140	295.5	148.	RICA	ALENIA	LABEN	PLM	3

Note 1: HTR-e are taken from CASA Heater P.N. 400900203CR0037

11. THERMOSTATS HARDWARE MATRIX

In the following table the TCS thermostats hardware matrix is reported.

TYPE	PART NUMBER	TEMP. THRESH.		Supplier	PROVIDED by:	INSTALLED by:	S/C module	TOTAL ENGINEER. QUANTITY
		ON	OFF					
TS-A	370200101BMLM04 (1)70 (2)30 H3	-23	-17	Elmwood	ALENIA	ALENIA	24 on PLM + 4 on SVM	28
TS-B	370200101BMLM04 (0)20 (0)80 H3	-8	-2	Elmwood	ALENIA	ALENIA	PLM	24
TS-C	370200101BMLM04 030 (0)30 H3	-3	+3	Elmwood	ALENIA	ALENIA	SVM	2
TS-D	370200101BMLM04 060 000 H3	0	6	Elmwood	ALENIA	ALENIA	SVM	2
TS-E	370200101B MLM04 230 170 H3	17	23	Elmwood	ALENIA	ALENIA	SVM	8
TS-F	370200101B MLM04 310 250 H3	25	31	Elmwood	ALENIA	ALENIA	SVM	32
TS-G	370200101B625 635H	-35	-25	Comepa	CASA	ALENIA	SVM	4
TS-H	370200101B620 630H	-30	-20	Comepa	CASA	ALENIA	SVM	4
TS-L	370200101B604 610H	-10	-4	Comepa	CASA	ALENIA	SVM	4
TS-M	370200101B010 000H	0	10	Comepa	CASA	ALENIA	SVM	12
TS-N	370200101B015 005H	5	15	Comepa	CASA	ALENIA	SVM	12
TS-P	370200101B017 011H	11	17	Comepa	CASA	ALENIA	SVM	8
TS-Q	370200101B026 020H	20	26	Comepa	CASA	ALENIA	SVM	32
TS-R	370200101BMLM04 000 (1)00 K	-10	0	Elmwood	ALENIA	**SAFT**	SVM	8
TS-S	370200101BMLM04 010 (0)50 K	-5	1	Elmwood	ALENIA	**SAFT**	SVM	8
TS-T	370200101BMLM04 420 220 K3	22	42	Elmwood	ALENIA	ALENIA	SVM	8
TS-U	370200101BMLM04 370 170 K3	17	37	Elmwood	ALENIA	ALENIA	SVM	8
TS-a	370200101BMLM04 (1)50 (2)10 H3	-21	-15	Elmwood	ALENIA	**LABEN**	PLM	6
TS-b	370200101BMLM04 (2)20 (2)80 H3	-28	-22	Elmwood	ALENIA	**LABEN**	PLM	6
TS-c	370200101BMLM04 (2)40 (3)00 H3	-30	-24	Elmwood	ALENIA	**LABEN**	PLM	2
TS-d	370200101BMLM04 (2)70 (3)30 H3	-33	-27	Elmwood	ALENIA	**LABEN**	PLM	2

ANNEX A

DELETED

ANNEX B -

THERMISTOR CALIBRATION CURVES

RESISTANCE
TEMPERATURE RELATIONSHIP TABLE

PT 500		G4.5K7D359		G0.5K1D322		G10K4D372		Fenvall 15K		YSI 44908 10K		GB32 ESA/SSC 4006/001	
TEMP	RESIST	TEMP	RESIST	TEMP	RESIST	TEMP	RESIST			TEMP	RESIST		
°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	Ohms
-200	85.90	-50	178526.46	-90	177595.60	-35	179281.53	-20	120000	-35	179.2K	-40	44135
-180	129.25	-45	131467.57	-85	123719.21	-30	135232.79	-15	92500	-30	135.2K	-20	14055
-160	172.30	-40	97833.31	-80	87324.57	-25	102889.46	-10	71800	-25	102.9K	0	5700
-140	214.50	-35	73534.31	-75	62408.01	-20	78930.14	-5	56300	-20	78.91K	5	4568
-120	256.60	-30	55798.80	-70	45131.50	-15	61030.59	0	44400	-15	61.02K	10	3678
-100	298.05	-25	42726.76	-65	33006.87	-10	47549.16	5	35300	-10	47.54K	15	2984
-80	339.05	-20	33001.62	-60	24399.46	-5	37315.93	10	28230	-5	37.31K	20	2437
-60	379.70	-15	25701.67	-55	18221.69	0	29490.00	15	22730	0	29.49K	25	2001
-40	420.10	-10	20175.23	-50	13741.22	5	23461.92	20	18410	5	2346K	30	1653
-20	460.15	-5	15957.17	-45	10459.19	10	18786.53	25	15000	10	1878K	35	1373
0	500.00	0	12712.50	-40	8032.04	15	15136.13	30	12290	15	15.13K	40	1146
20	539.45	5	10197.87	-35	6220.70	20	12267.76	35	10130	20	12.26K	45	961
40	578.65	10	8235.01	-30	4857.11	25	10000.00	40	8390	25	10000.00	50	809
60	617.65	15	6692.29	-25	3822.00	30	8196.44	45	6990	30	8194.00	55	685
80	656.40	20	5471.76	-20	3029.94	35	6753.87	50	5850	35	6752.00	60	583
100	694.95	25	4500.00	-15	2419.21	40	5593.68	56	4758	40	5592.00	65	498

RESISTANCE
TEMPERATURE RELATIONSHIP TABLE

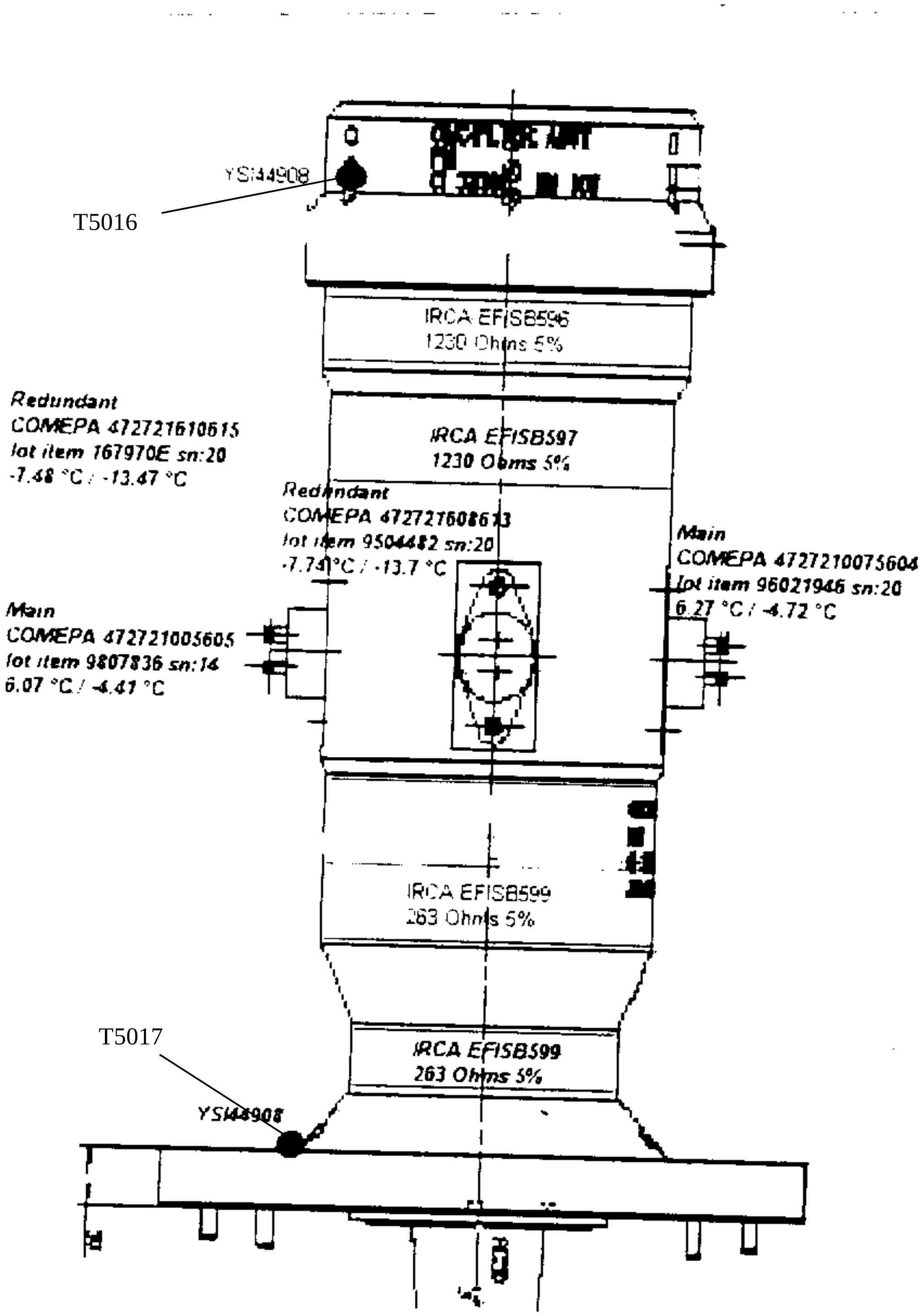
PT 500		G4.5K7D359		G0.5K1D322		G10K4D372		Fenvall 15K		YSI 44908 10K		GB32 ESA/SSC 4006/001	
TEMP	RESIST	TEMP	RESIST	TEMP	RESIST	TEMP	RESIST			TEMP	RESIST		
°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	Ohms
140	771.30	30	3721.60	-10	1944.82	45	4655.63	60	4159	45	4655.00	70	428
180	846.75	35	3094.42			50	3893.31	65	3531	50	3893.00	75	368
220	921.25	40	2586.26			55	3270.73	70	3009	55	3270.00	80	319
		45	2172.29			60	2759.86	74	2659	60	2760.00	90	241
		50	1833.30			65	2338.72			65	2338.00	100	185
						70	1990.00			70	1990.00	110	144
						75	1700.01			75	1700.00	120	113
						80	1475.85			80	1476.00	125	101
						85	1256.00			85	1256.00		
						90	1084.00			90	1084.00		

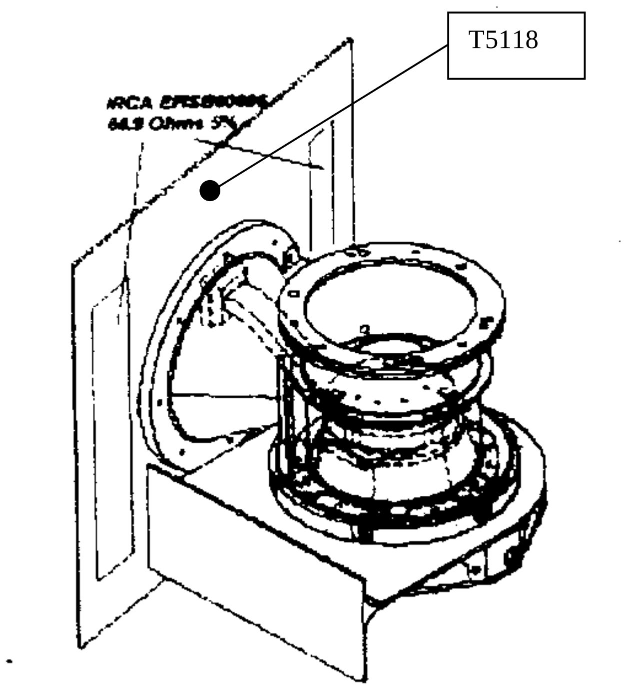
ANNEX C
RELATIONSHIP WHIT THERMOSTAT AND SERIAL NUMBER

THERMOSTAT-SERIAL NUMBER
Type A= 370200101BMLM04(1)70(2)30H3
Type B= 370200101BMLM04(0)20(0)80H3

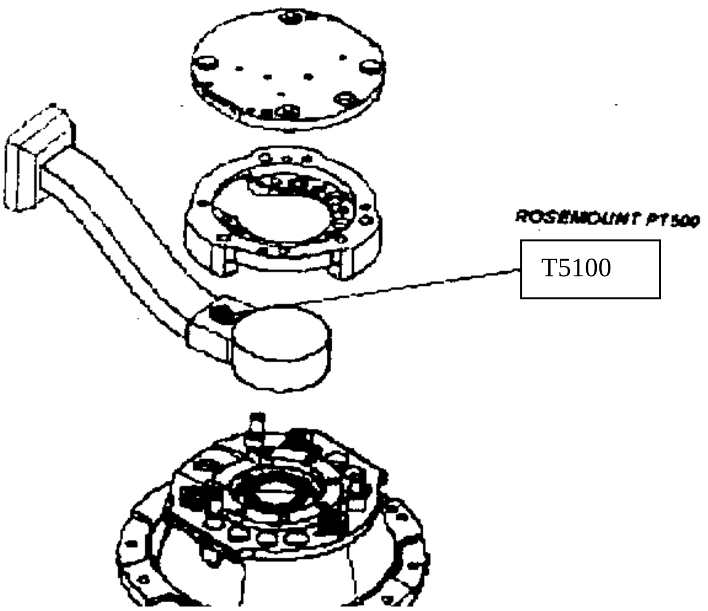
TYPE A	SERIAL NUMBER	TYPE B	SERIAL NUMBER
TSA1	39	TSB1	4
TSA2	50	TSB2	7
TSA3	12	TSB3	1
TSA4	26	TSB4	26
TSA5	28	TSB5	31
TSA6	16	TSB6	18
TSA7	14	TSB7	28
TSA8	36	TSB8	12
TSA9	38	TSB9	35
TSA10	25	TSB10	29
TSA11	29	TSB11	34
TSA12	27	TSB12	16
TSA13	32	TSB13	17
TSA14	55	TSB14	30
TSA15	56	TSB15	27
TSA16	37	TSB16	23
TSA17	30	TSB17	24
TSA18	31	TSB18	15
TSA19	42	TSB19	33
TSA20	43	TSB20	3
TSA21	44	TSB21	20
TSA22	47	TSB22	14
TSA23	48	TSB23	19
TSA24	13	TSB24	36

ANNEX D
OMC – Thermostats and heaters location (AD 10)



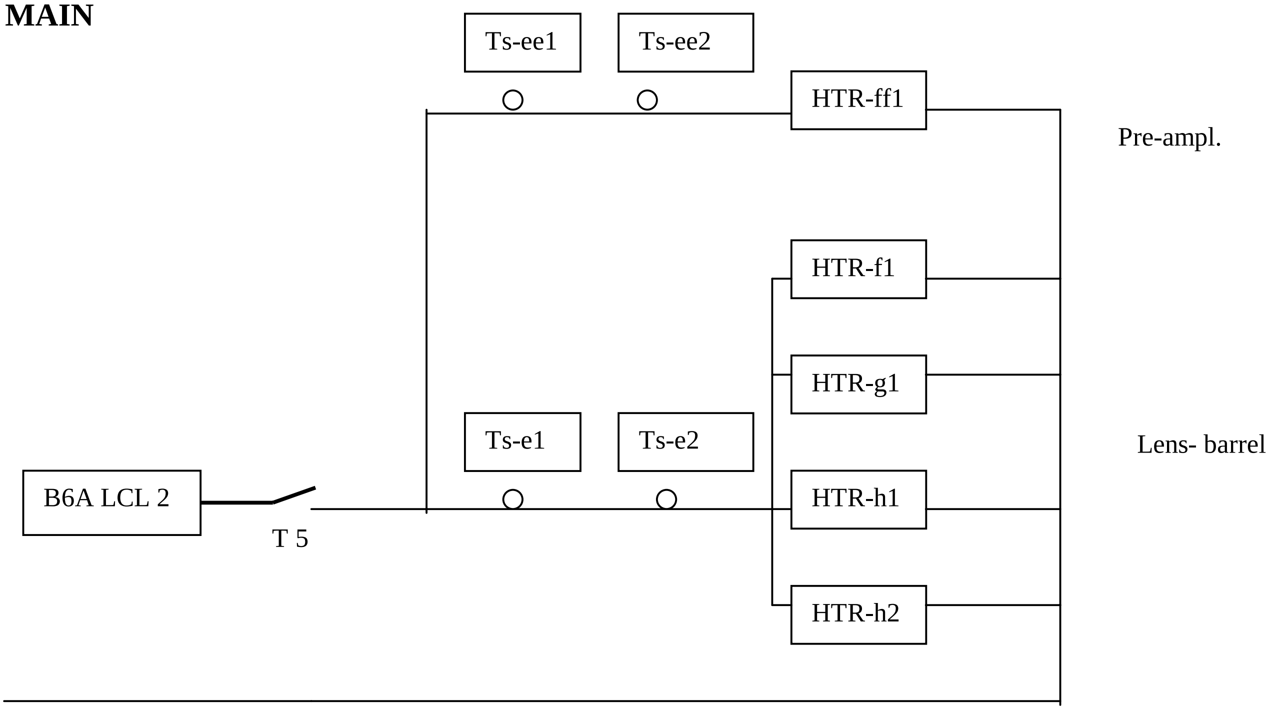


.- Rosemount PT500 118MF500AB, on cold finger

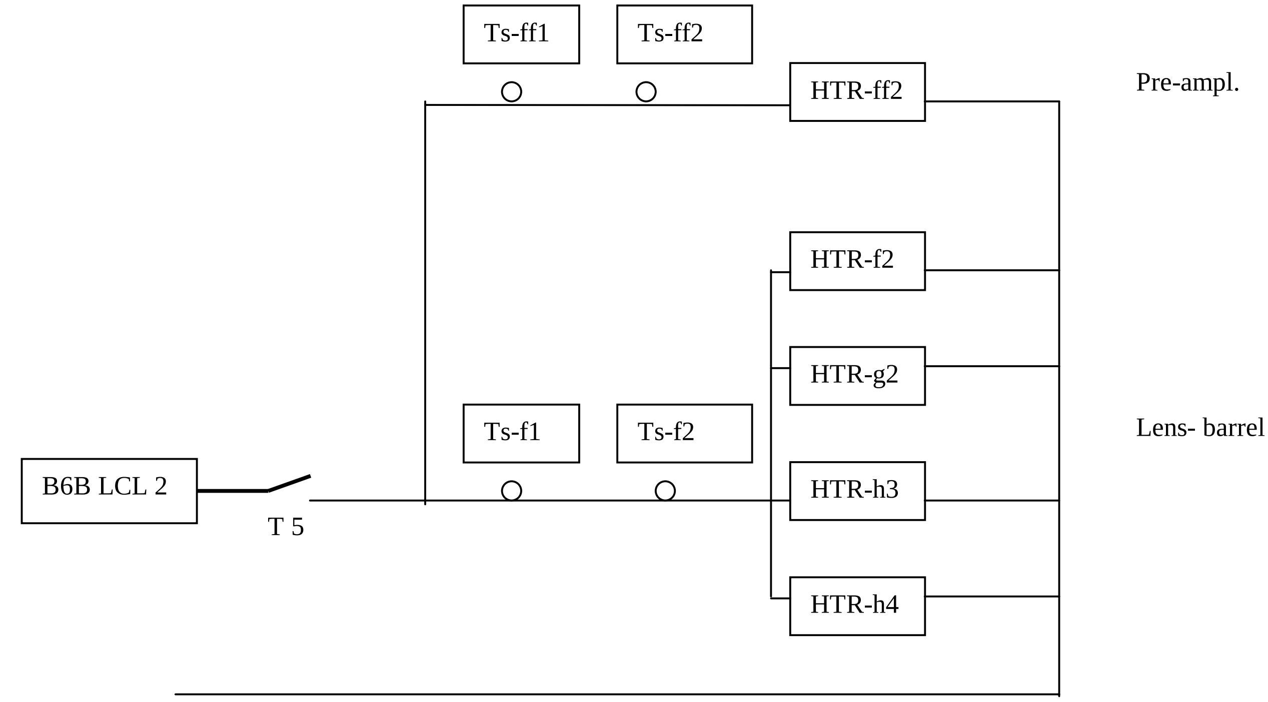


OMC lens barrel heater and thermostats electrical diagrams:
Power at 26.5 V: 6.5 W (lens barrel) + 1.8 W (pre-amplificator)

MAIN

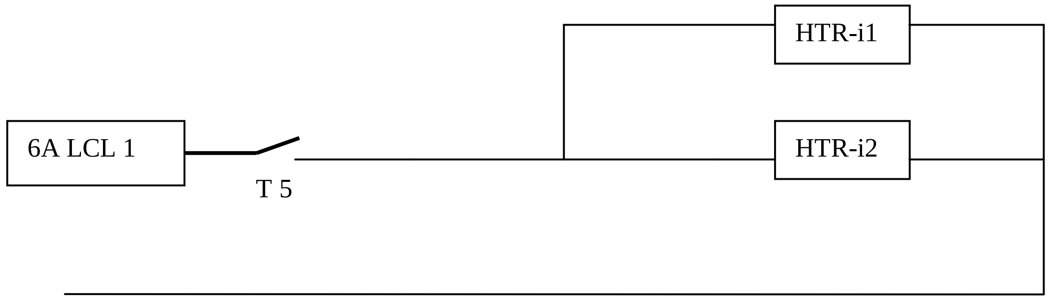


REDUNDANT

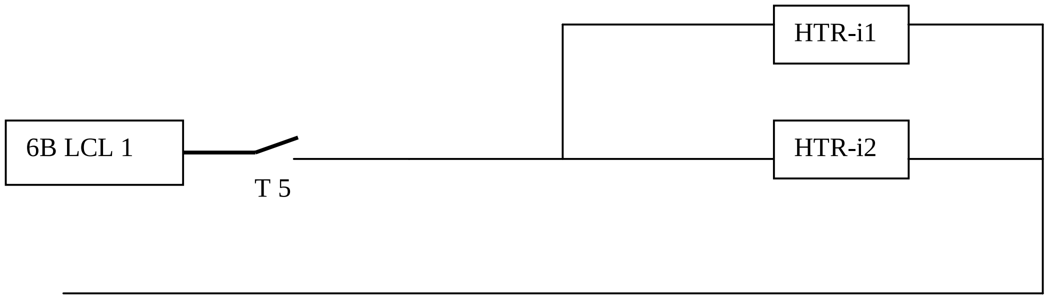


OMC CCD heater electrical diagrams:
Nominal Power at 26.5 V: 21.64 W

MAIN



REDUNDANT



ANNEX E (AD 14):
Figure E1-1: IBIS HEATER LAYOUT

Fig. 3.3.4.2.2-1 ISGRI SPIDER - Heaters configuration

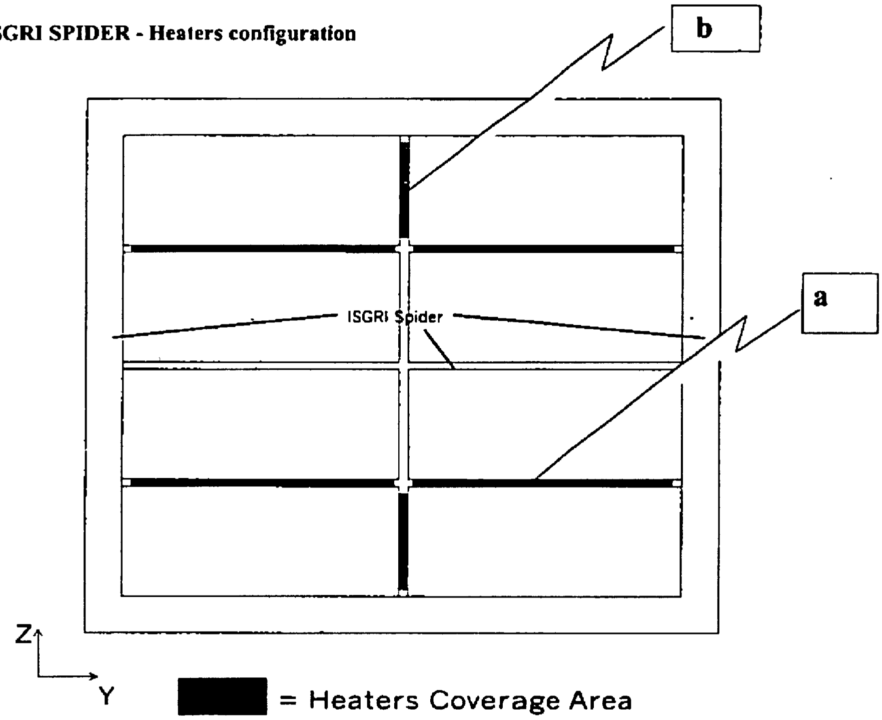
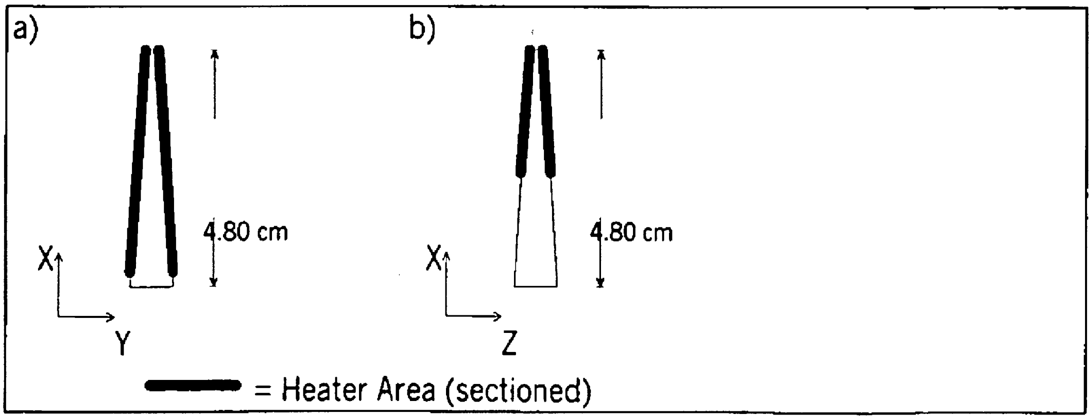


Fig. 3.3.4.2.2-2 ISGRI SPIDER - Beam Sections and Heaters Coverage Area



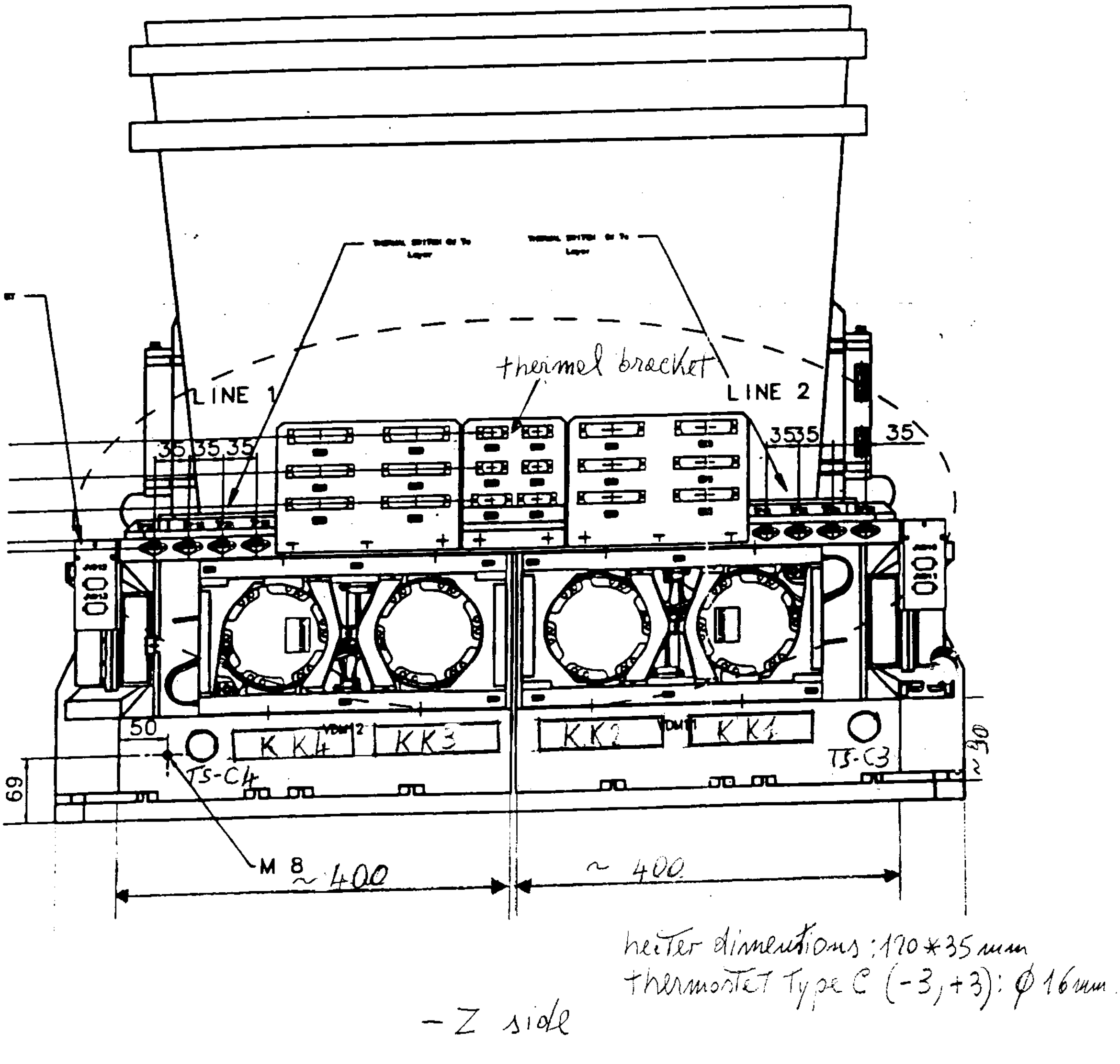


Figure E1-2: IBIS COMPENSATION HEATERS LAYOUT

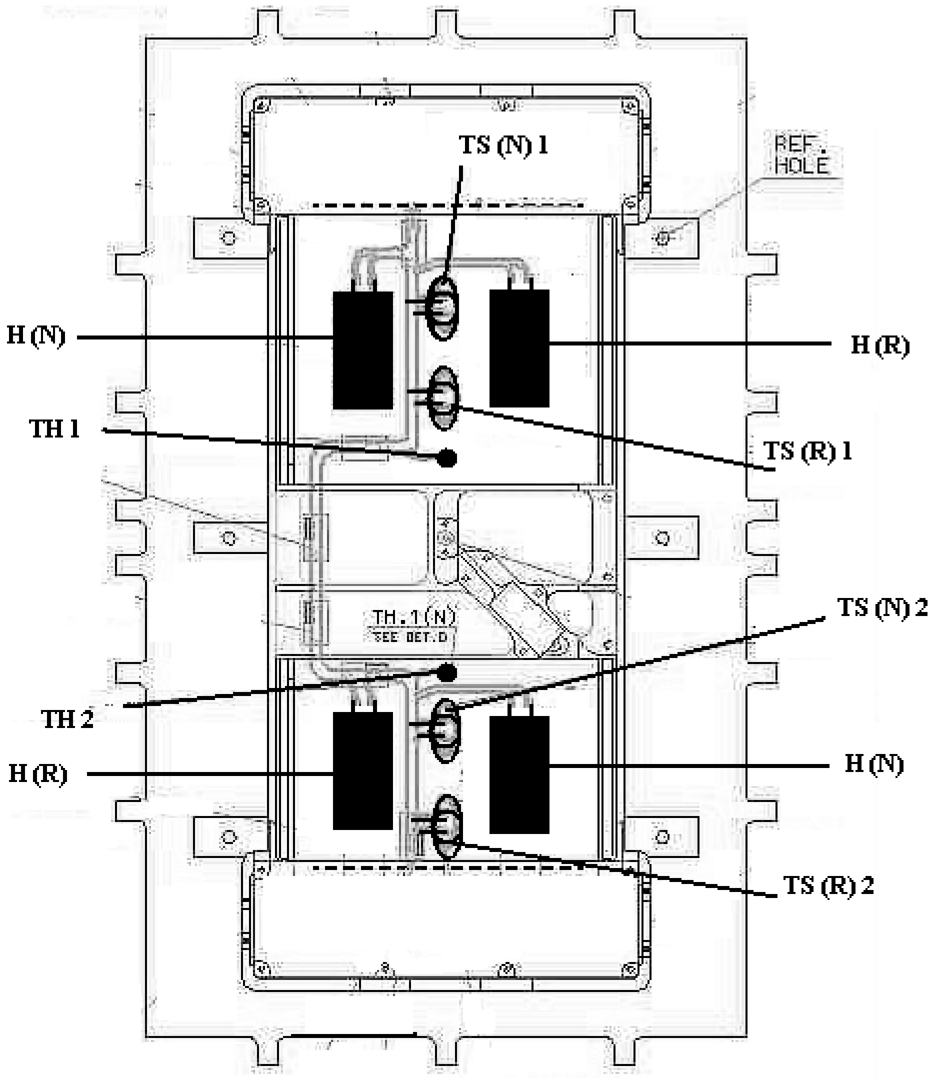
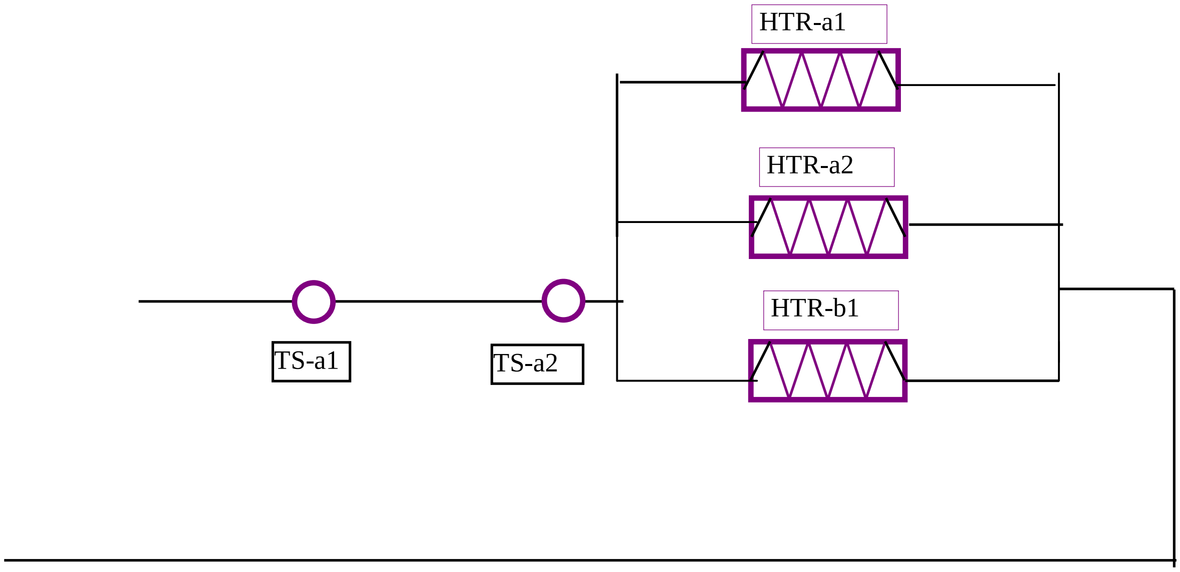


Figure E1-3: CALIBRATION UNIT HEATERS LAYOUT

ANNEX E

Figures E2.1: IBIS CdTe 1 electrical scheme

PDU LCL = 5A.1.6 POWER= 48W (main)



)

PDU LCL = 5B.1.6 POWER= 48W (redundant)

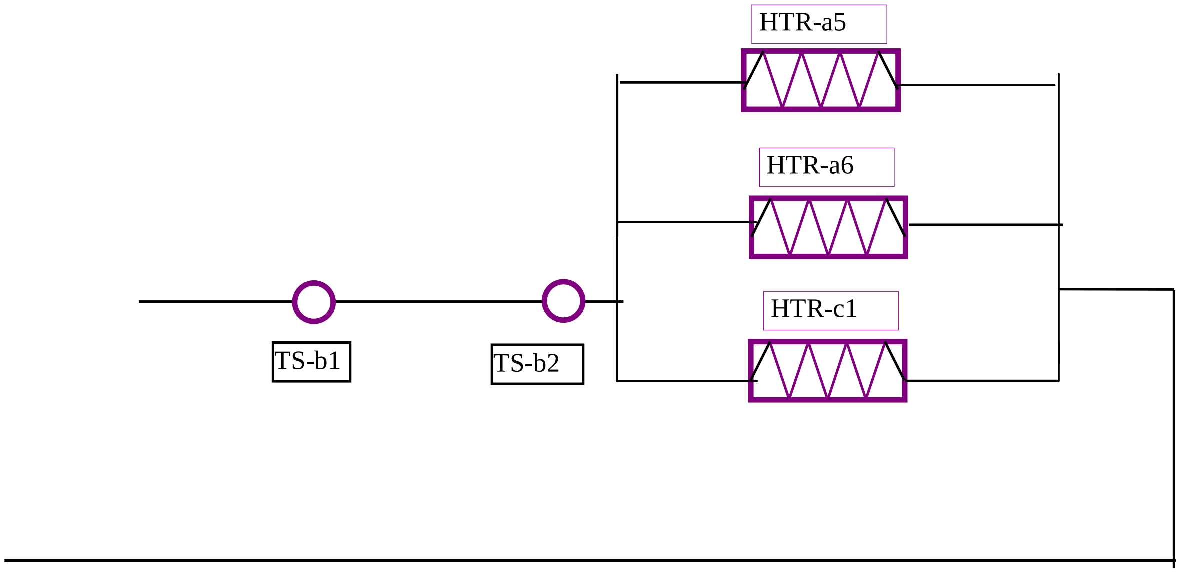
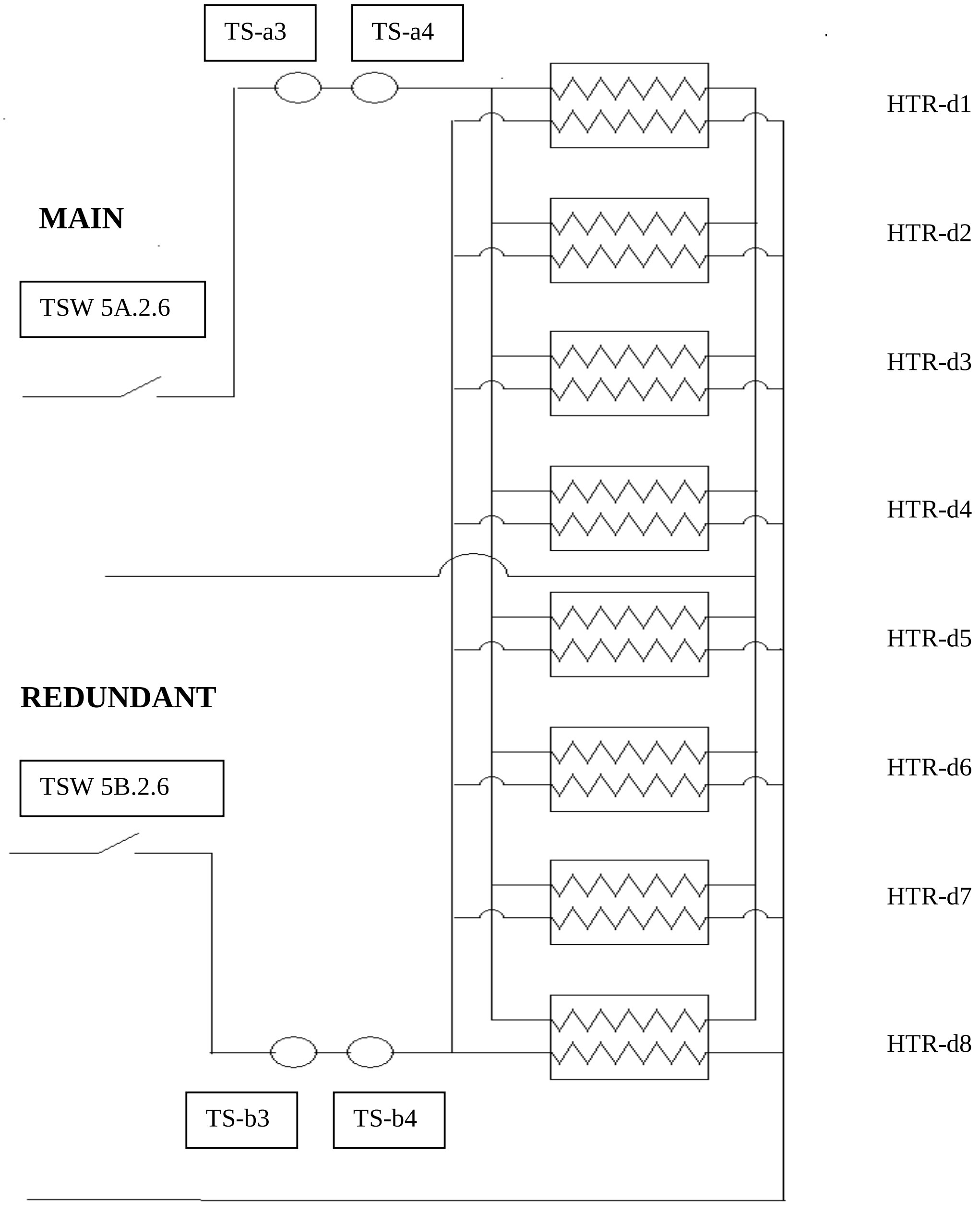


Figura E2.2 IBIS CsI electrical scheme

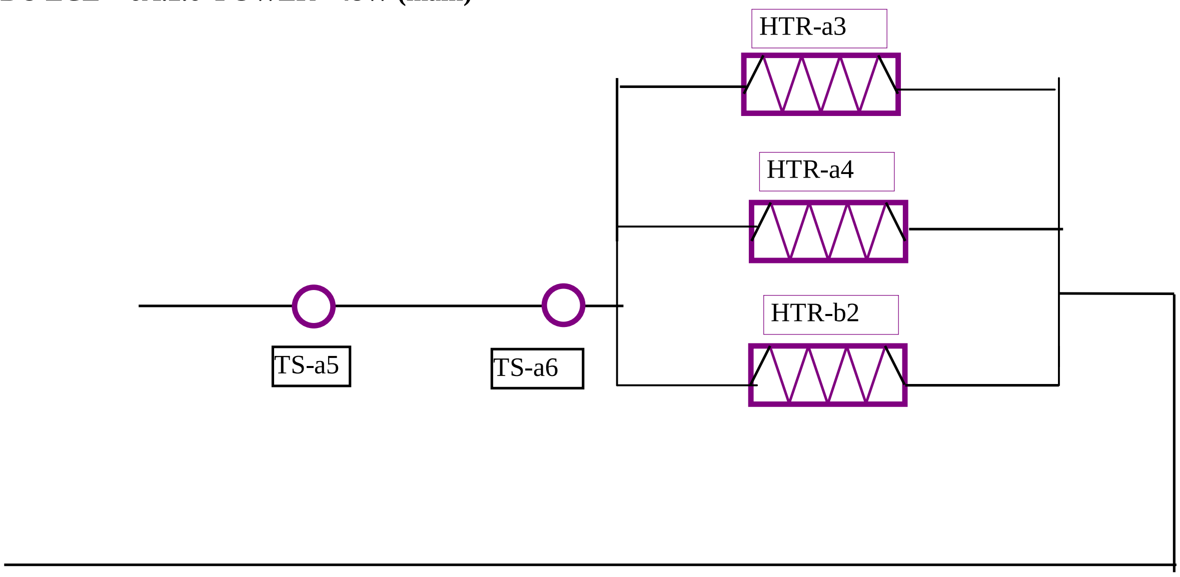
PDU LCL =5A.2.6 IBIS CsI =40.W (main)



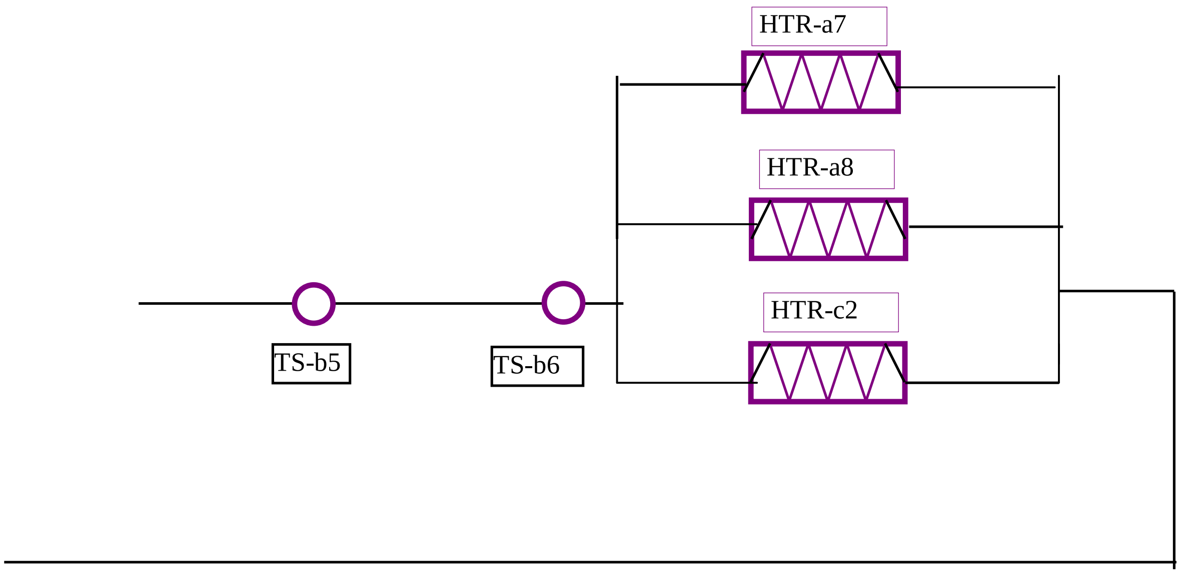
PDU LCL =5B.2.6 IBIS CsI =40.W (redundant)

Figures E2.3: IBIS CdTe 2 electrical scheme

PDU LCL = 6A.2.6 POWER= 48W (main)

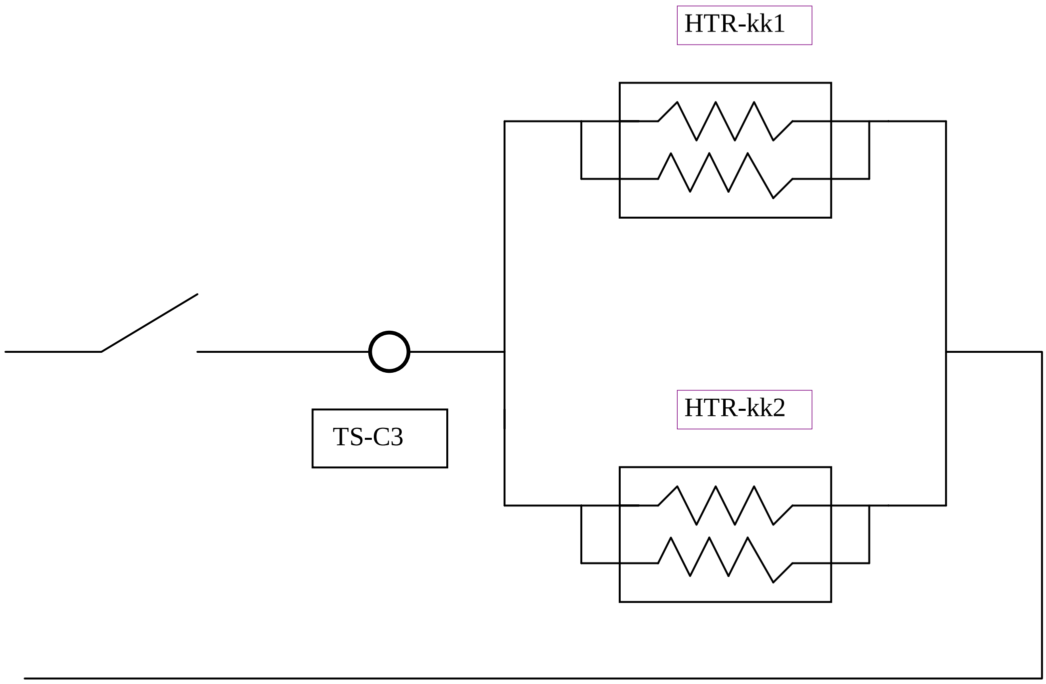


PDU LCL = 6B.2.6 POWER= 48W (redundant)

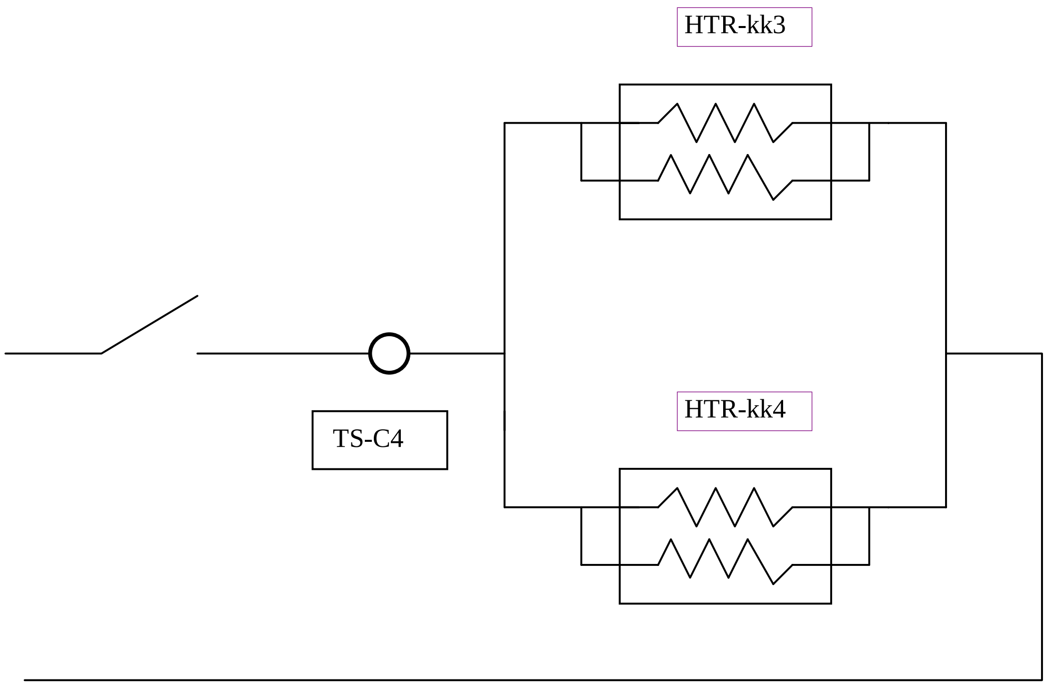


Figures E2.4: IBIS Detector Compensation heaters - electrical scheme

PPDU BOARD 6-A LCL = 2 TSW=5 POWER=20 W (main)

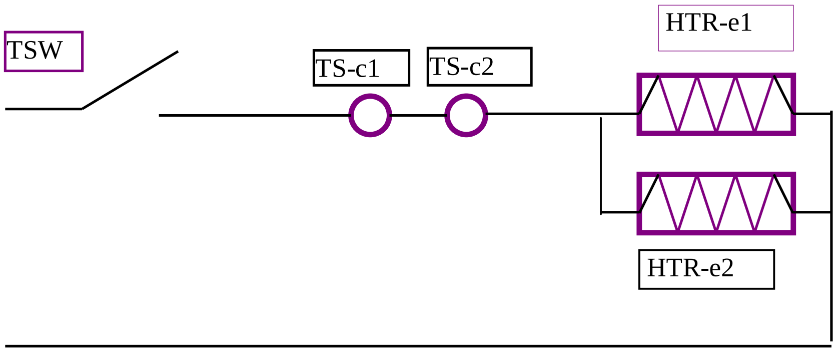


PPDU BOARD= 5-B LCL = 1 TSW=5 POWER=20 W (redundant)

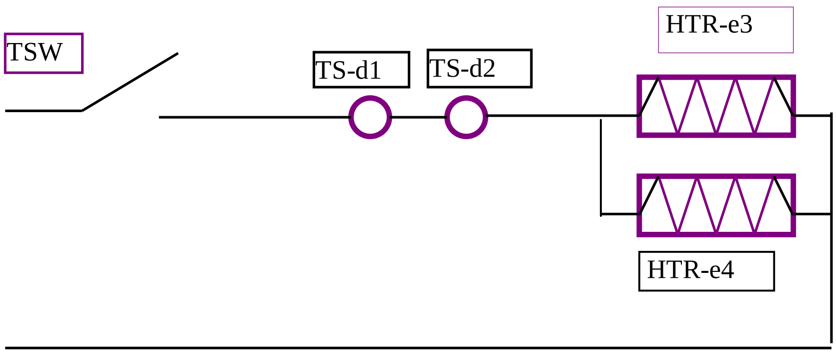


Figures E2.5: Calibration Unit heaters - electrical scheme

PPDU BOARD 6-A LCL = 1 TSW=2 POWER=4 W (main)



PPDU BOARD 6-B LCL = 1 TSW=2 POWER=4 W (redundant)



ANNEX F – SPI (AD8, AD9)

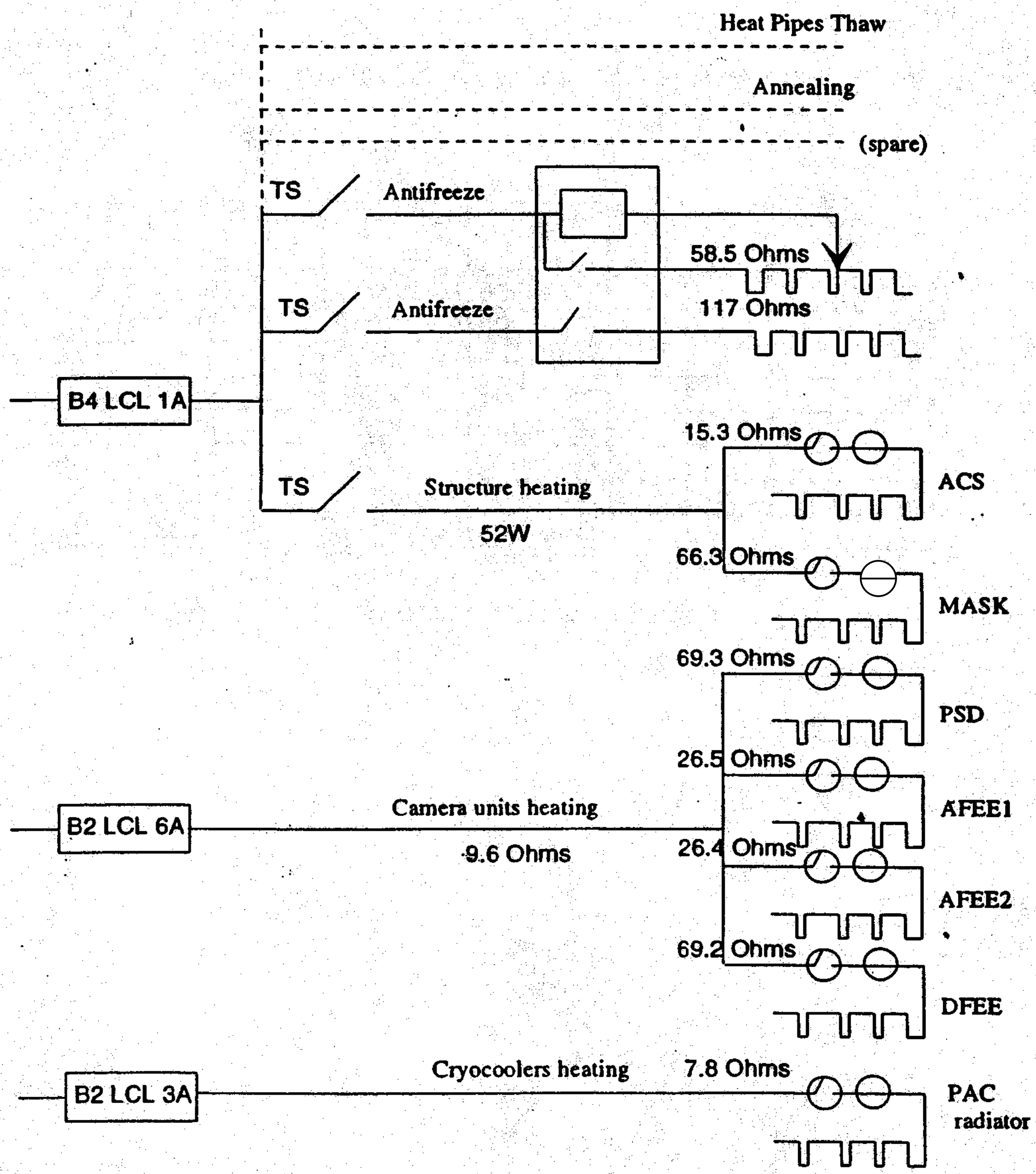


Figure 3.a.: thermal control lines and heater circuits

ELECTRICAL SCHEME

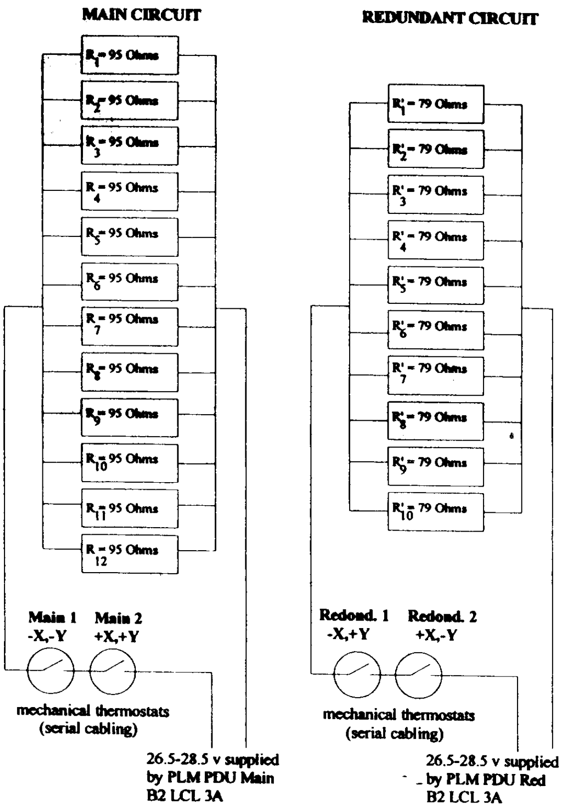
RECHAUFFEURS ASSURANT LE DÉMARRAGE DES MACHINES CRYOGÉNIQUES

Etant données les puissances de réchauffage mises en jeu (environ 100 W) et le souci de limiter la densité de puissance, les réchauffeurs d'une ligne requièrent une surface de collage importante (environ 450 cm²).
En outre, l'utilisation de "réchauffeurs double couches" (nominal / redondant) a été évitée afin de fiabiliser le système.
Ainsi, la faible surface disponible sur la structure des machines n'a pas permis d'implanter au plus près des machines les réchauffeurs nominaux et les réchauffeurs redondants.
Les réchauffeurs de la ligne nominale sont donc implantés sur la structure des machines, et ceux de la ligne redondante sur le radiateur associé aux machines cryogéniques (cf implantation en annexe 3).

La figure 4.2 présente le schéma de cablage et l'alimentation de ces lignes de réchauffage.

FM CRYOCOOLERS SWITCH-ON HEATERS CIRCUITS :

(Main heaters fitted on SPICO bracket - Redundant heaters fitted on ACC radiator)



Single layers heaters are used
The equivalent resistance of each circuit is 7.9 Ohms => 87 W under 26.5 v

Main Heaters Dimensions are 50 mm x 75 mm
Redondant Heaters Dimensions are 50 mm x 125 mm

Cablage et alimentation des réchauffeurs pour le démarrage des machines ***(heaters2.dsf - page 2)***

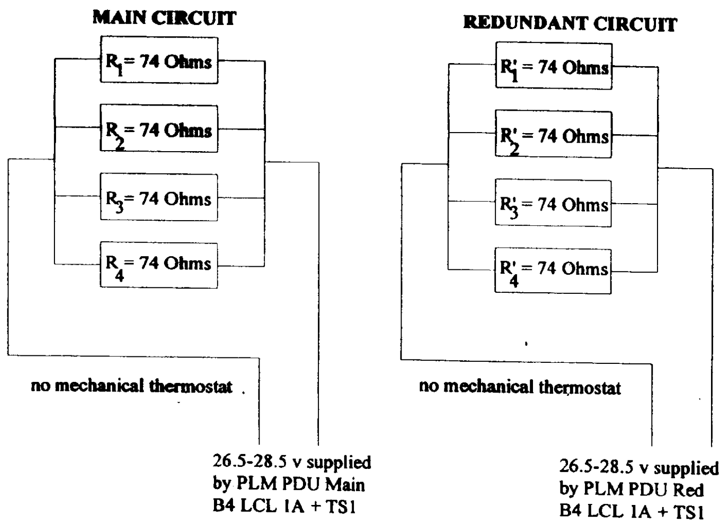
RECHAUFFEURS ASSURANT LE DÉGEL DES CALODUCS

Ces réchauffeurs seront typiquement activés suite à un mode instrument inactif (ou satellite en mode survie), ou encore après la phase d'acquisition d'orbite.
L'utilisation de ces réchauffeurs autorise également le dégazage de toutes les structures constituant l'étage intermédiaire du cryostat.

Les réchauffeurs de la ligne nominale et de la ligne redondante sont implantés sur le radiateur froid passif, avec un souci de répartition du réchauffage pour un dégel homogéne (cf schéma d'implantation présenté en annexe 3).

La figure présente le schéma de cablage et l'alimentation de ces lignes de réchauffage.

FM HEAT PIPES THAW HEATERS CIRCUITS



The equivalent resistance of each circuit is 18.5 Ohms => 37 W under 26.5 v

Single layers heaters areused

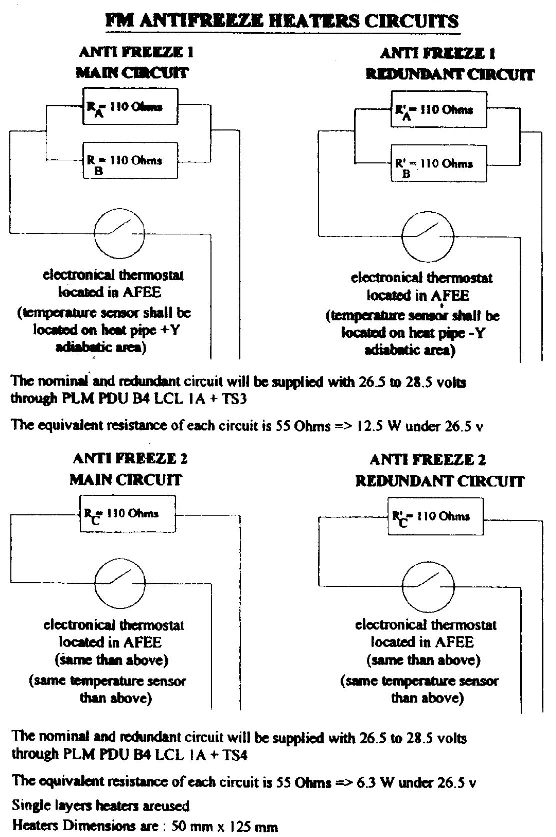
Heaters Dimensions are : 125 mm x 75 mm

Cablage et alimentation des réchauffeurs pour le gel des caloducs *(heaters2.dsf - page 4)*

RECHAUFFEURS ASSURANT LA SÉCURITÉ ANTIGEL DES CALODUCS

L'ammoniac contenu dans les caloducs géle à -77°C (196 K). Ce gel doit être évité lors de toutes les phases opérationnelles de l'instrument pour diminuer les entrées de chaleur vers l'étage froid et garder une bonne stabilité de température au niveau des détecteurs.
La surface radiative du radiateur froid passif est optimisée de sorte être la plus basse possible, sans toutefois solliciter ce réchauffage dans l'environnement le plus chaud présenté par la plateforme et l'instrument (Tammoniac = 210 K). Pour des températures d'interface plus faibles, une régulation électronique (cf §5.) garantit une température d'ammoniac comprise entre 205 K et 208 K.

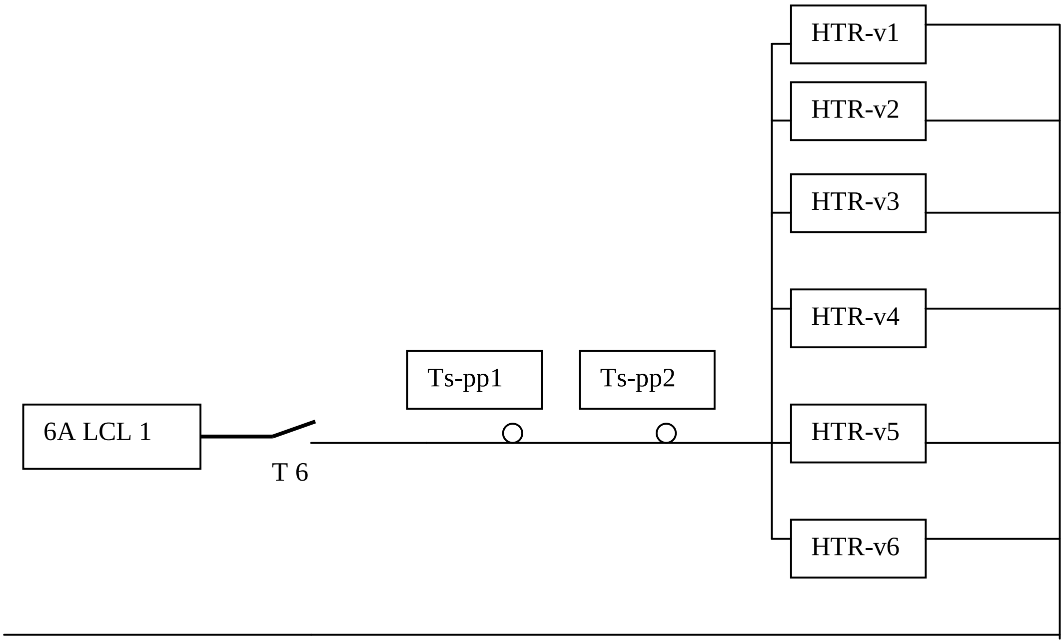
Lorsque les préamplificateurs dissipent, la puissance nécessaire à cette régulation est moins importante que dans les modes où la chaîne de détection est inactive. Ainsi le dispositif d'antigel (cf §5.2) est à deux vitesses (régime "12W" ou "12W + 6 W") selon l'état électrique des préamplificateurs.
Les réchauffeurs de la ligne nominale et de la ligne redondante sont implantés sur le radiateur froid passif, au plus près de la zone adiabatique, conformément au schéma d'implantation présenté en annexe 3.
La figure 4.4 présente le schéma de cablage et l'alimentation de ces lignes de réchauffage.



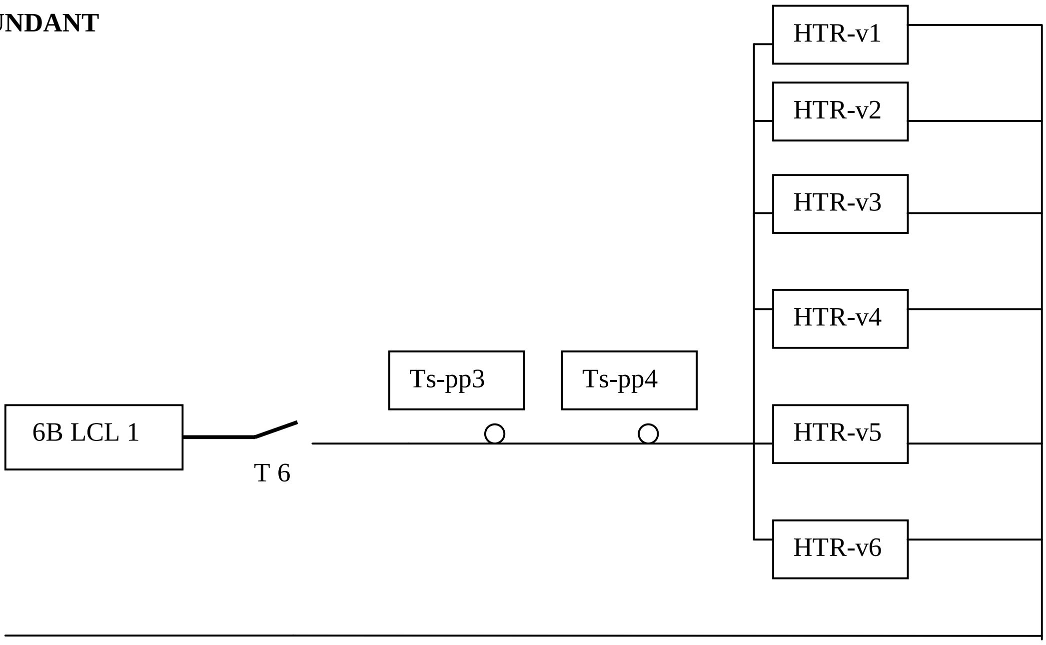
Cablage et alimentation des réchauffeurs pour la sécurité antigel des caloducs ***(heaters2.dsf - page 5)***

SPI COMPENSATION HEATERS & THERMOSTATS

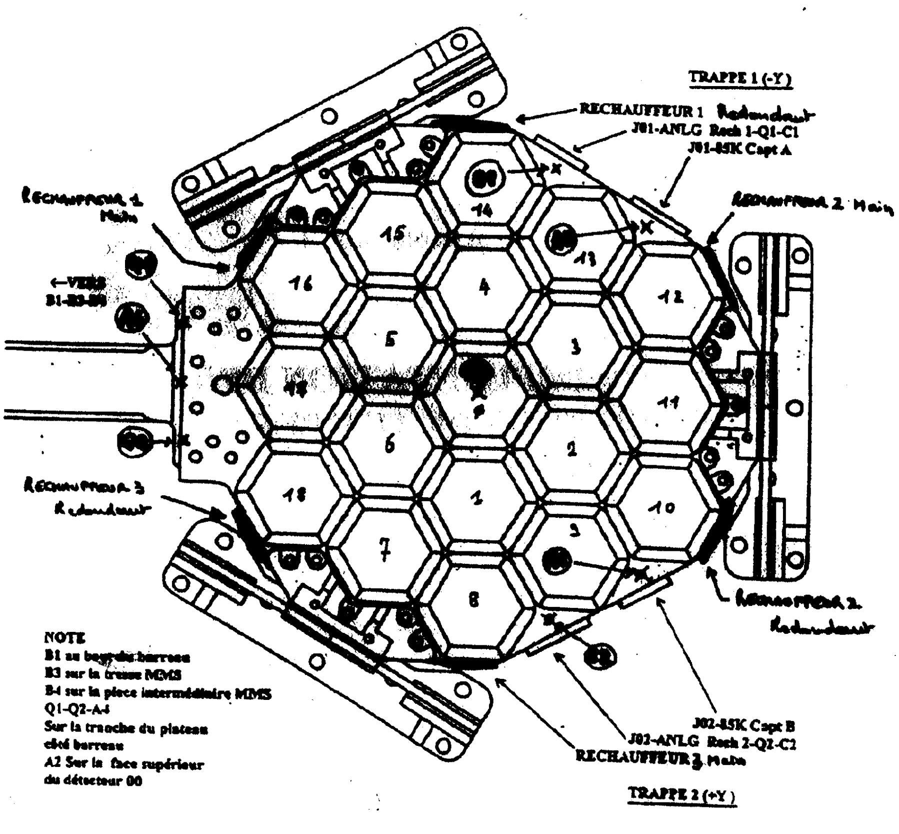
MAIN



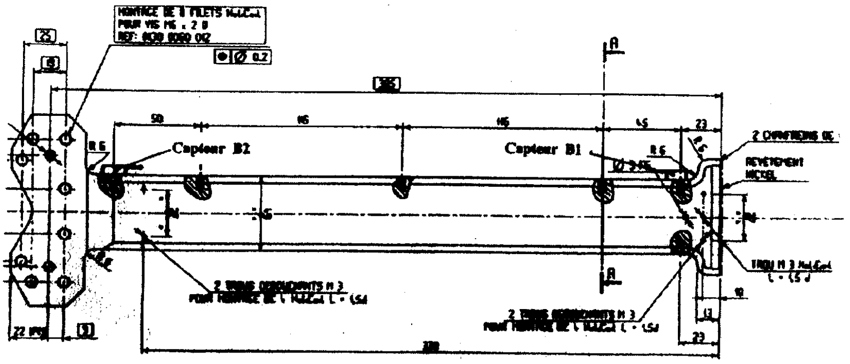
REDUNDANT

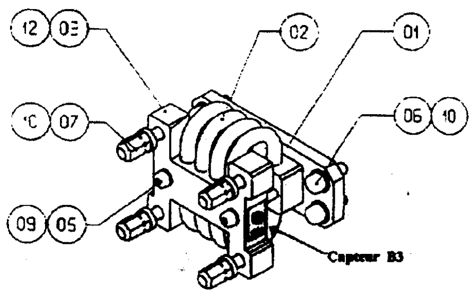


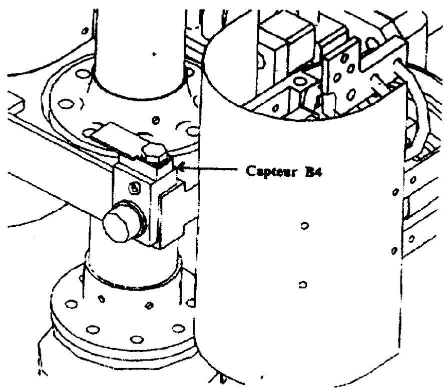
Implantation des capteurs sur le plateau froid (vue de dessus)
(A1 A2 A3 A4 Q1 Q2 C1 C2)



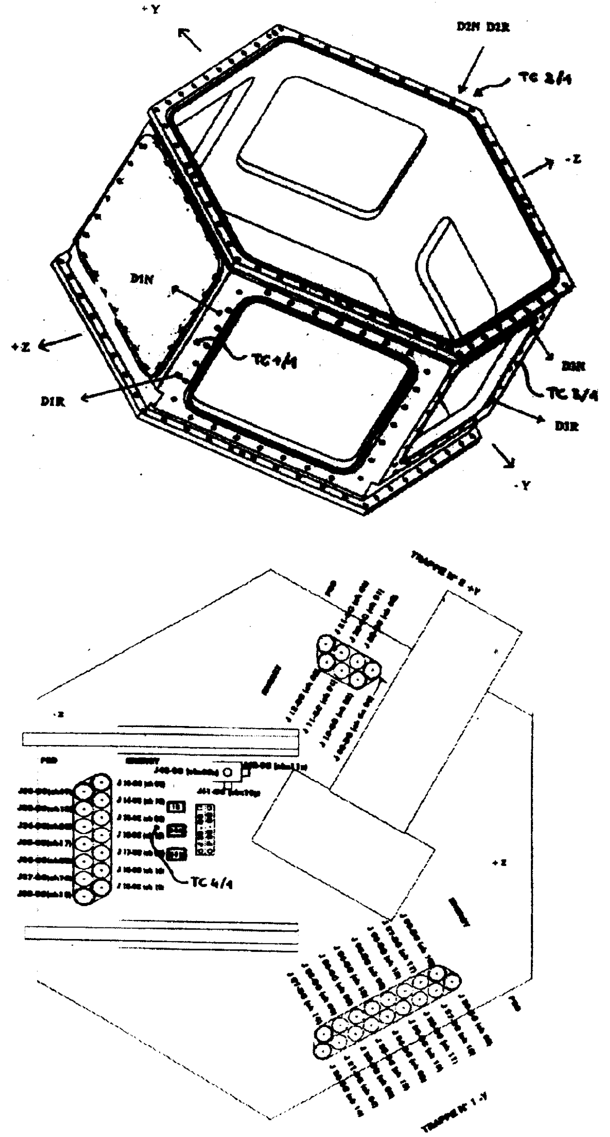
Implantation des capteurs sur le barreau froid (vu de dessus), la tresse et le "H bus"
(B1 B2 B3 B4)



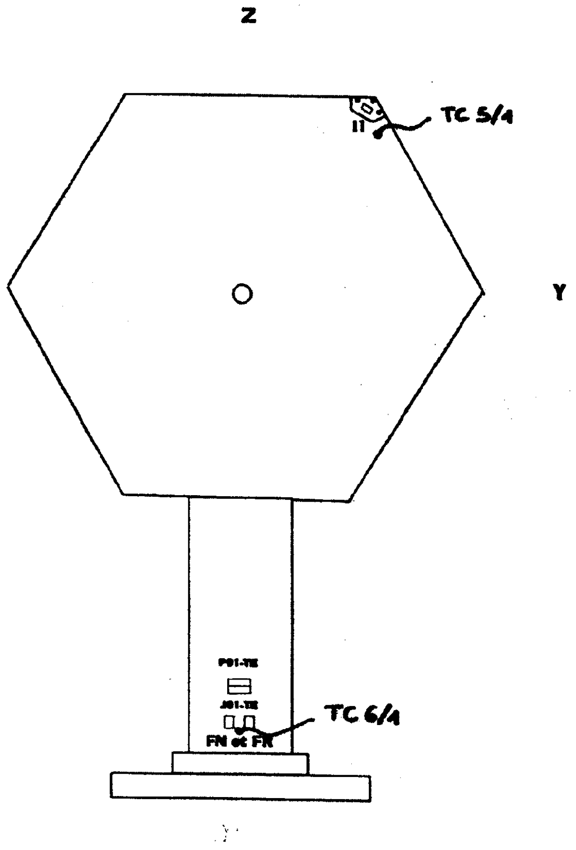




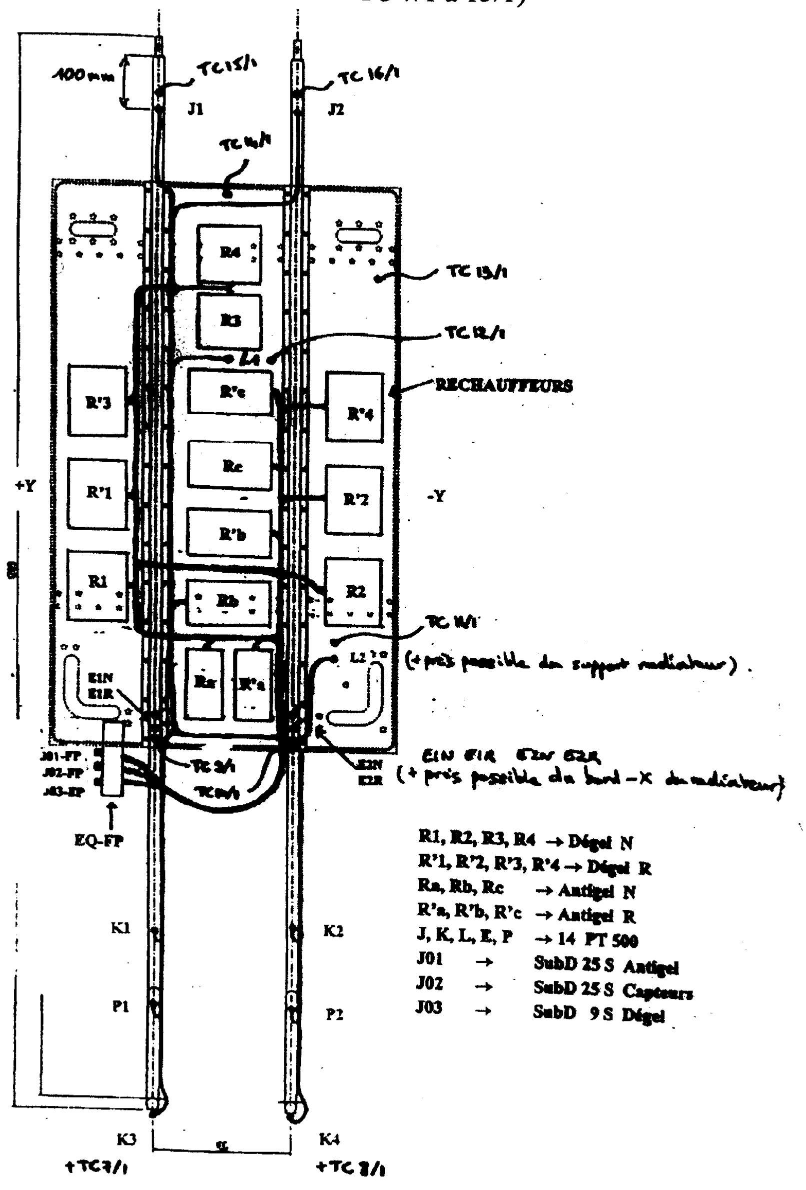
Implantation des capteurs sur la virole et la semelle de l'enceinte
(D1N D1R D2N D2R D3N D3R D4N D4R I2
+ TC 1/1 2/1 3/1 4/1)



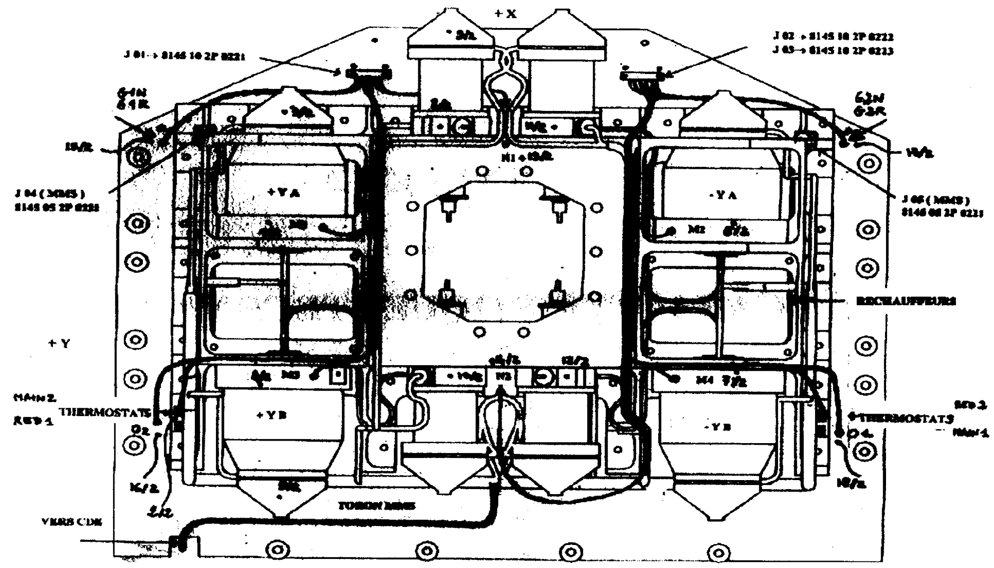
Implantation des capteurs sur le couvercle de l'enceinte et le tube étanche (vus de dessus)
(I1 FN FR + TC 5/1 6/1)

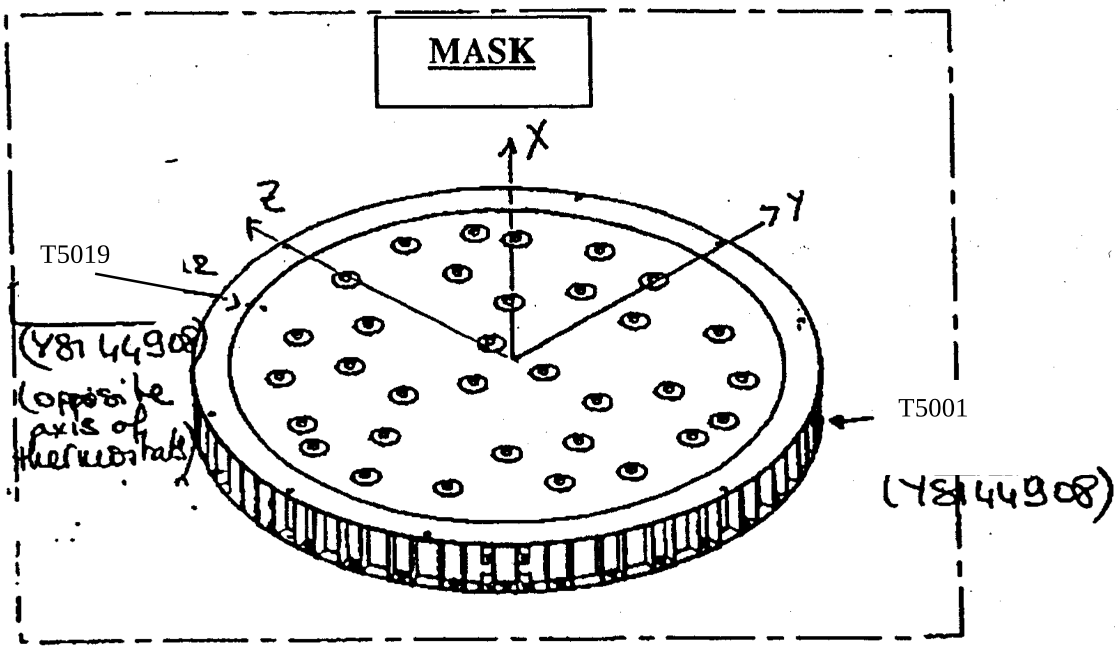


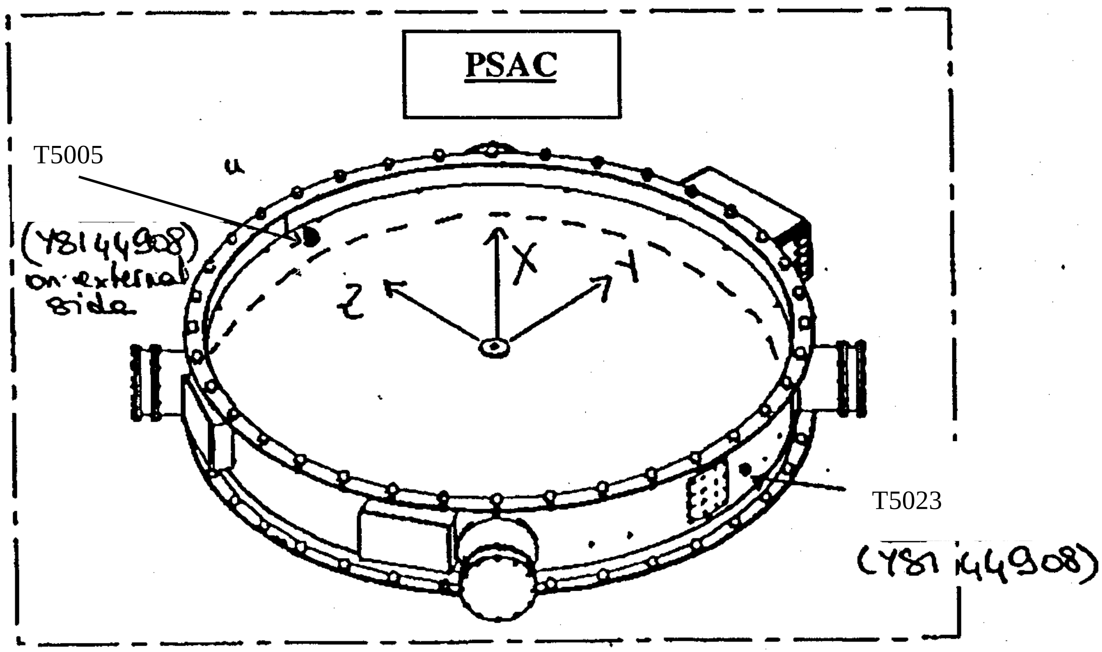
Implantation des capteurs sur le sous ensemble froid passif
(E1N E1R E2N E2R J1 J2 K1 K2 K3 K4 L1 L2 P1 P2
+ TC 7/1 à 15/1)



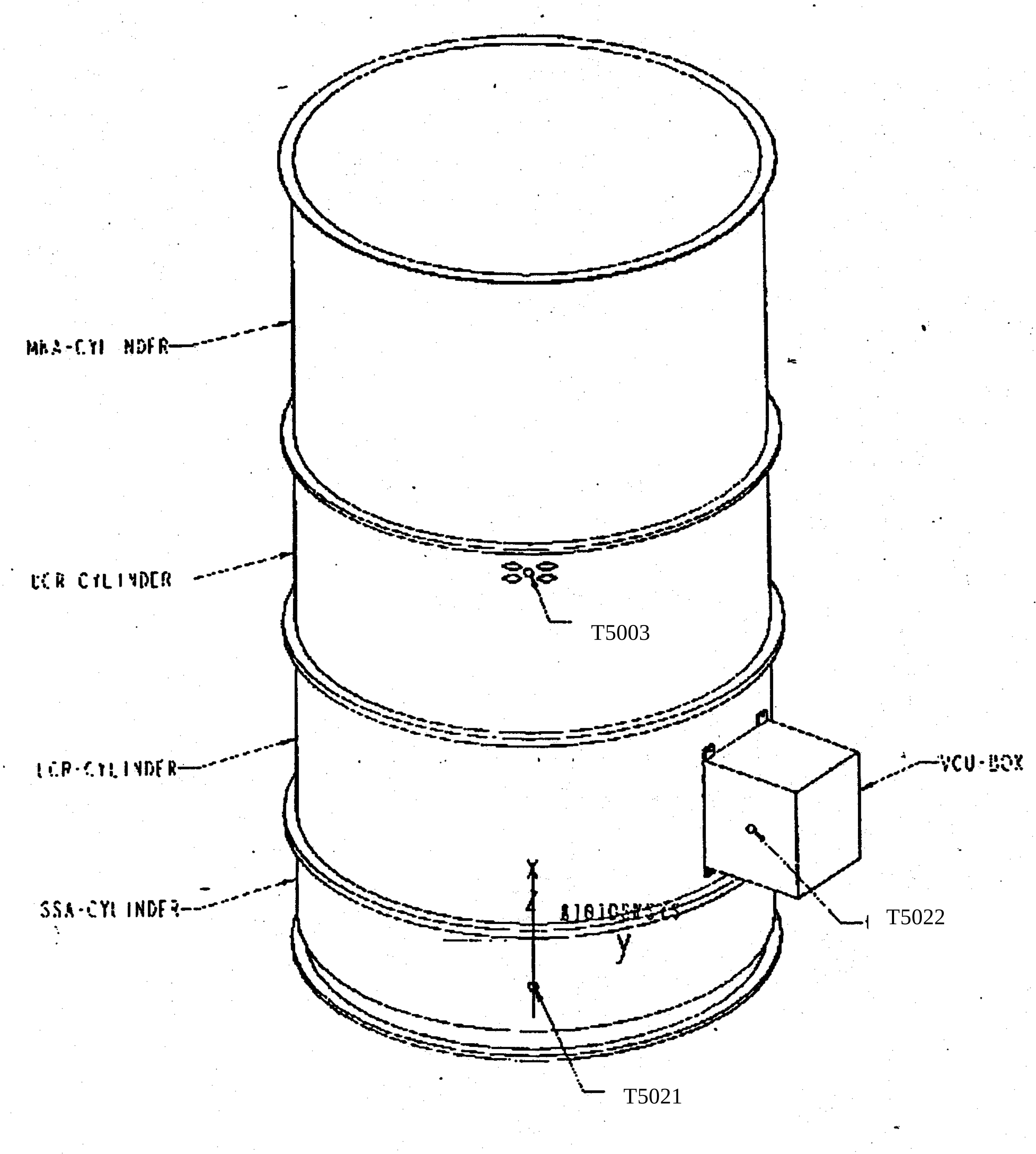
Implantation des capteurs sur le sous ensemble froid actif
(G1N G1R G2N G2R M1 M2 M3 M4 N1 N2 O1 O2
+ TC 1/2 à 18/2)



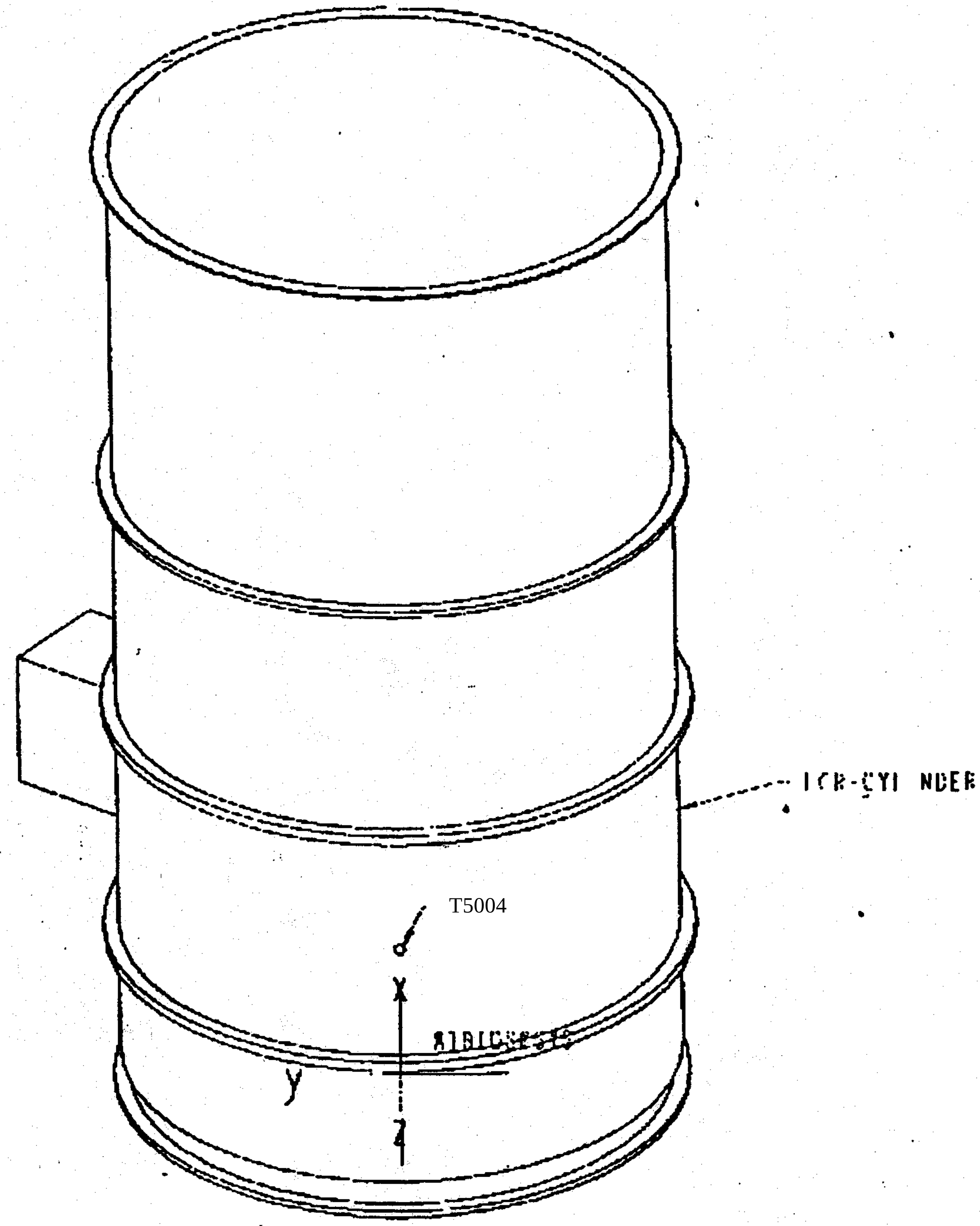




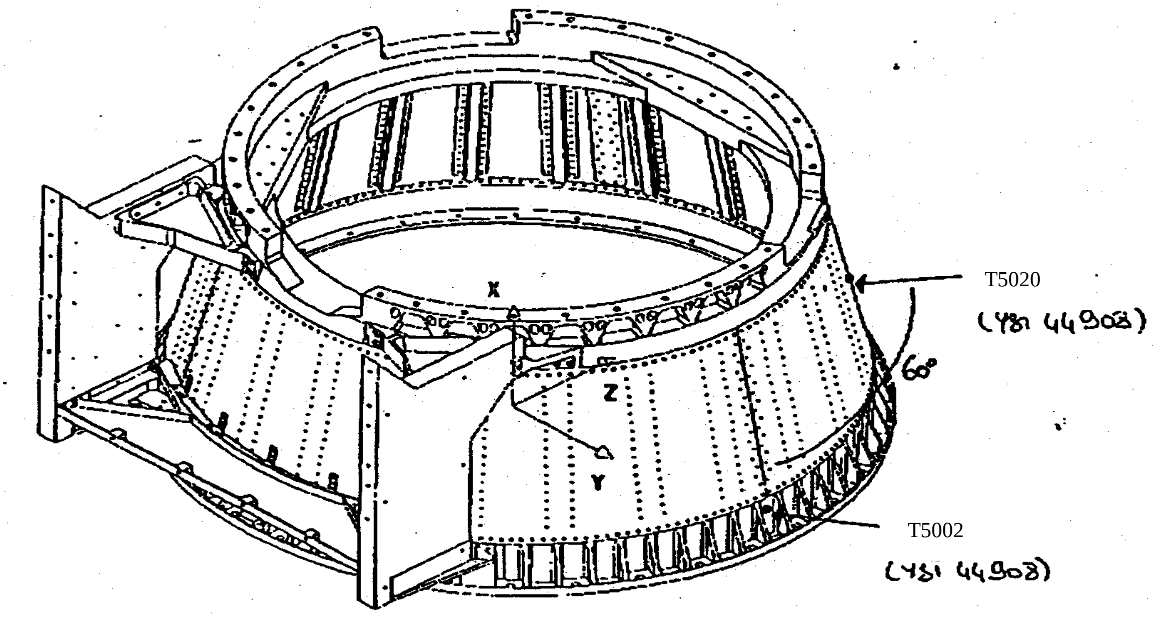
MASK and PSAC flight temperature sensors: T5001, T5019, T5005 and T5023



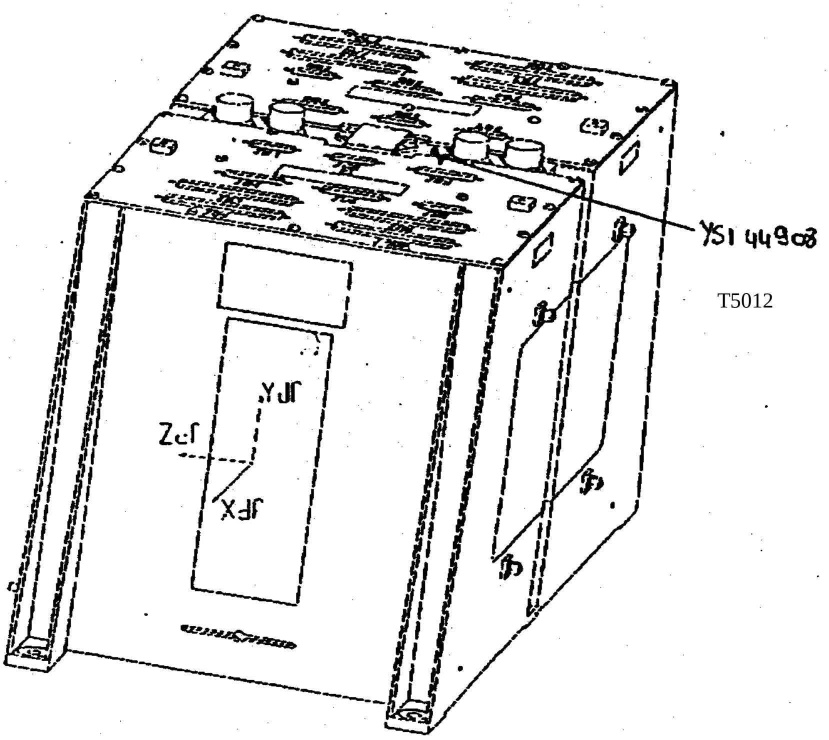
ACS flight temperature sensors: T5003, T5021 and T5022



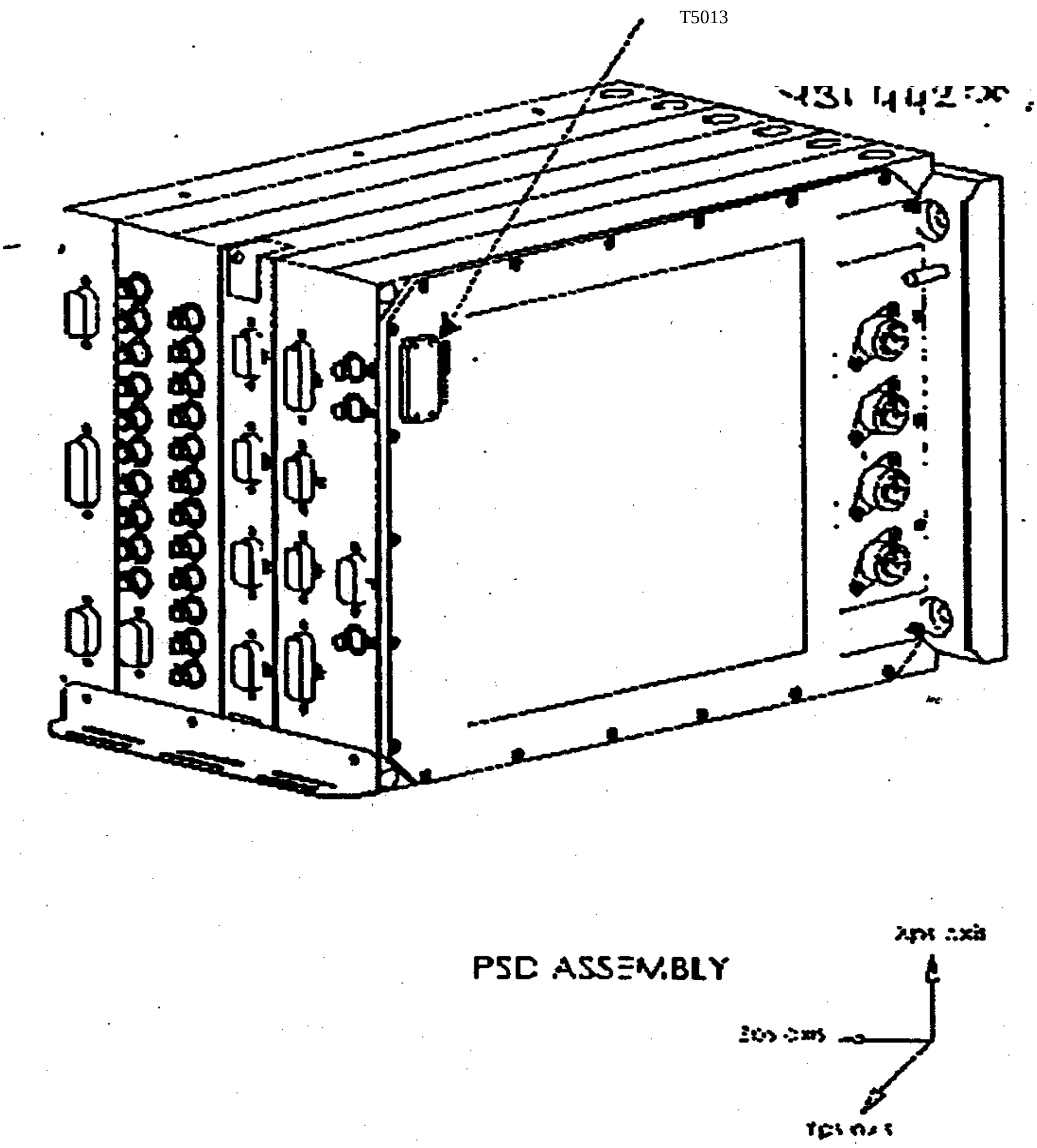
ACS flight temperature sensors: T5004



LSA Flight temperature sensors: T5002 and T5020



DFEE Flight temperature sensor: T5012



PSD Flight temperature sensor T5013

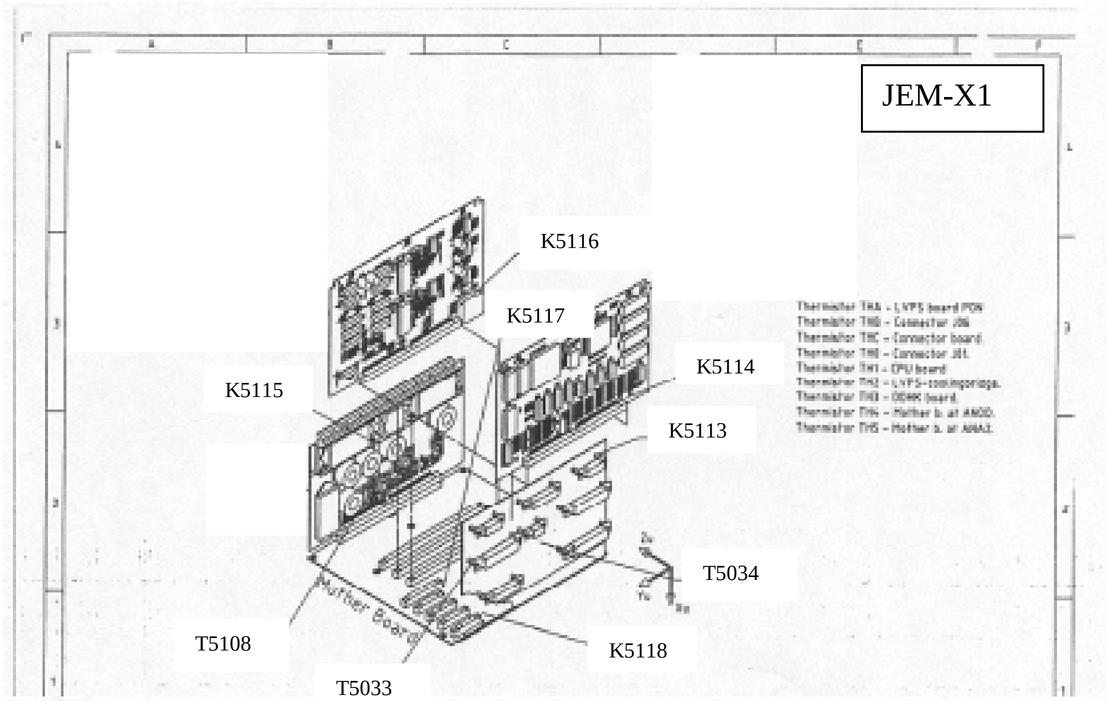
Drawing missing

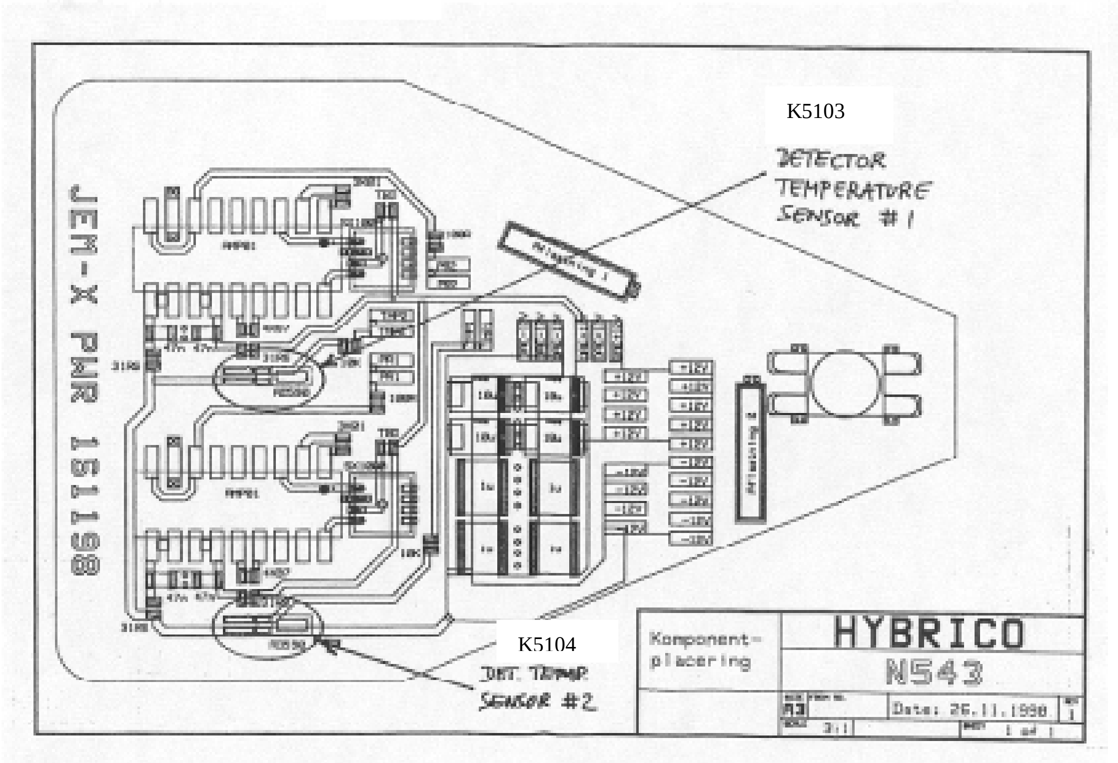
AFEE1 Flight temperature sensor T5010

Drawing missing

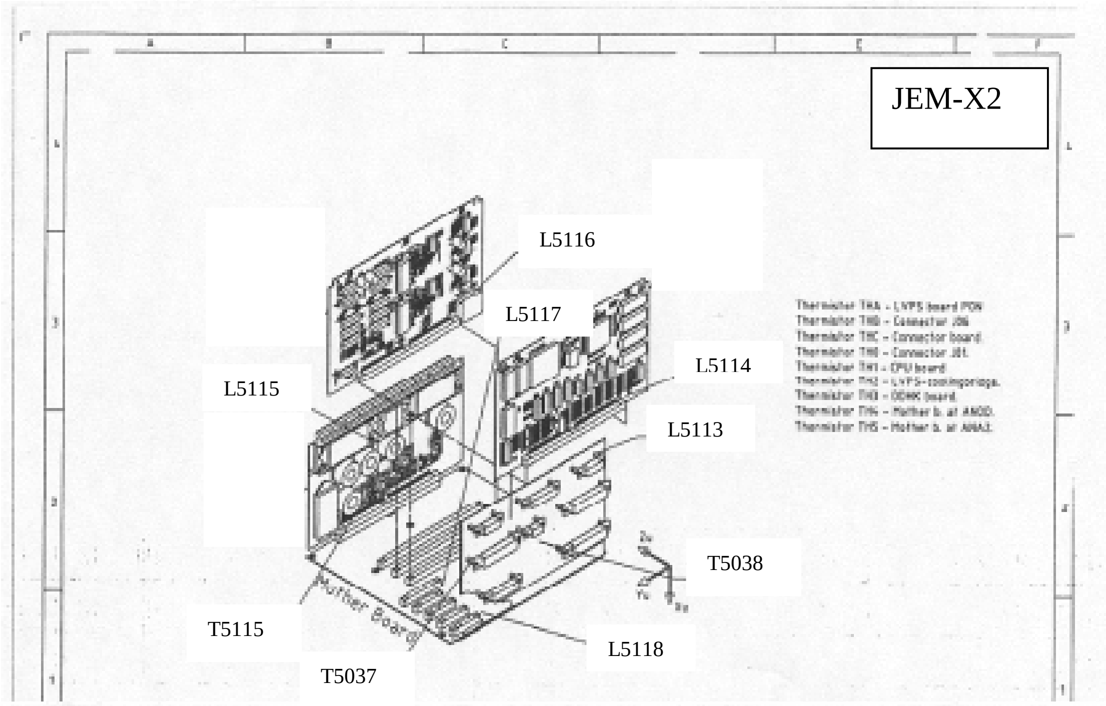
AFEE2 Flight temperature sensor T5011

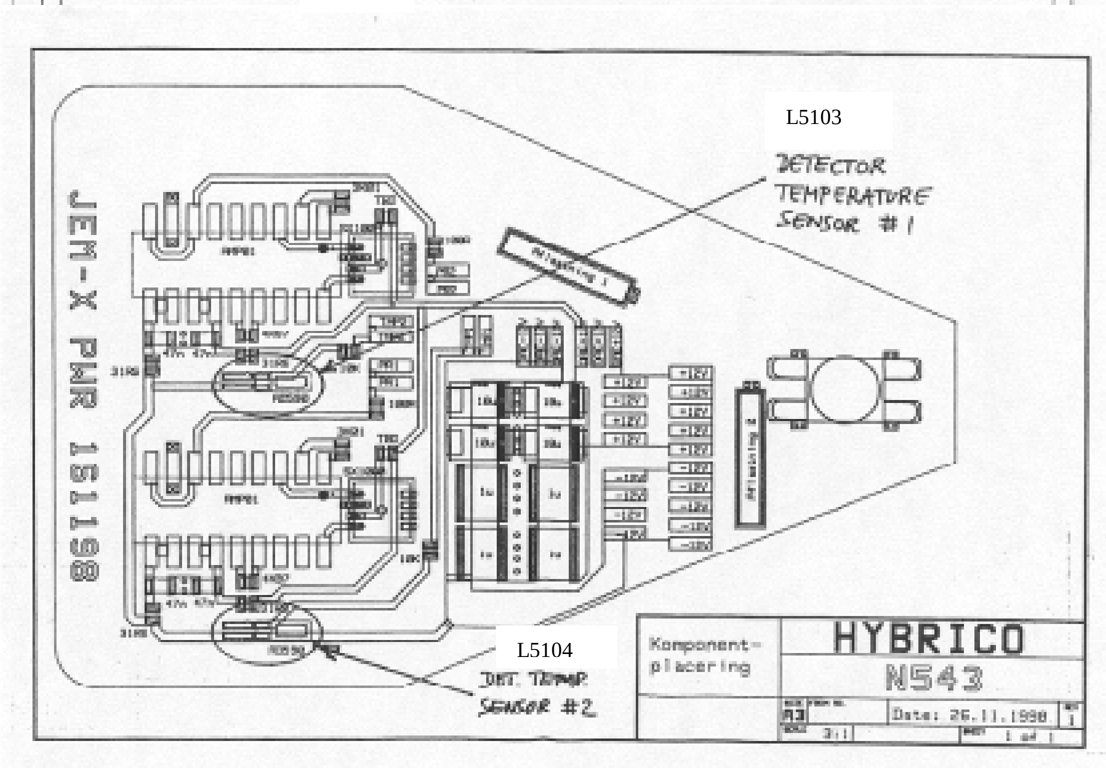
ANNEX G (AD 11)
JEM-X – Thermostats and heaters location





IN THIS DRAWING K5379 AND K5380 ARE NOT SHOWN





IN THIS DRAWING L5379 AND L5380 ARE NOT SHOWN