
Fabrication & Supply of Mini-Cooling Manifold

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List of Abbreviations

- **BOQ:** Bill of Quantities
- **DM Water:** Demineralized Water
- **FAT:** Factory Acceptance Test
- **GTAW:** Gas Tungsten Arc Welding
- **HART:** Highway Addressable Remote Transducer Protocol
- **IP-65:** Ingress Protection Rating 65
- **MOC:** Material of Construction
- **MTC:** Material Test Certificate
- **NABL:** National Accreditation Board for Testing and Calibration Laboratories
- **OEM:** Original Equipment Manufacturer
- **PIT:** Pressure Indicator cum Transmitter
- **PLC:** Programmable Logic Controller
- **PRV:** Pressure Reducing Valve
- **RTD:** Resistance Temperature Detector
- **SAT:** Site Acceptance Test
- **SLD:** Single Line Diagram
- **SS:** Stainless Steel
- **TIG:** Tungsten Inert Gas (Welding)

1. Scope of Supply

Supply of mini cooling manifold along with fittings, accessories & instrumentation as per below tabulation.

S. No.	Name of deliverables		Quantity
1	Supply Manifold assembly with	Pressure indicator cum transmitter	As per BOQ mentioned in table 2.
		Valves & Fittings	
		Bellow (Metallic flexible hose)	
2	Return Manifold assembly with	Flowmeter	
		RTD	
		Valves & Fittings	
		Bellow (Metallic flexible hose)	
3	Integrated PLC unit for instrumentation		As per quantity & details mentioned in table 7.

Table 1: Scope of Supply

2. Scope of Work

The main scope of work includes fabrication & supply of mini cooling manifold as per attached drawings along with fitting, accessories & instrumentation.

Details are summarized below:

1. Study of schematic and drawings as per attached Annexure-2
2. Procurement of all required materials/items as per the specifications and as per the attached schematics & drawings in Annexure-2.
3. **Only TIG/ GTAW welding to be used in fabrication** for piping and structure. Cutting, machining and fabrication of suitable components of SS 304 material with appropriate dimensions like C Channels, Pipes, flanges etc. as per attached schematics & drawings in Annexure-2.
4. It is preferred that prefabricated SS 304 piping module along with support structures properly fitted/ mounted using U clamp with piping fittings and instrumentation be supplied at site for fast installation and erecting work, consequently reducing the work hour in the lab due to the limited available work space.
5. Performing Hydro-test and other relevant tests of the assembled system conforming with the specifications.

6. Delivery of prefabricated assemblies and accessories to ITER-India site.
7. Obtain the work permit from ITER-India, before start of execution of work.
8. **Minor modification work and integration of the mini cooling manifold with the existing cooling distribution manifold using U clamps and welding to create a stable assembly for operational and testing activities.**
9. Power supplies, PLC unit modules, and other electronic accessories need to be installed on an SS 304 service plate and then integrated into the **existing electrical panel at the ITER-India site**. This includes cabling works from the panel to the instruments.
10. It is within the contractor's scope to propose any necessary changes and improvements in the design to meet the fabrication/ assembly requirements.
11. Supplier to present/submit material test certificates for any of the procured raw materials if requested by ITER-India.
12. The following points are to be kept in mind:
 - a. Cleaning of the site on a regular basis at the end of the day as per the satisfaction of the engineer-in-charge or authorized personnel.
 - b. Working hours available generally at the site will be 9:30 a.m. to 17:30 p.m. from Monday to Friday, excluding any government-declared holiday.
13. Please refer to https://www.ipr.res.in/documents/safety_protocols.html for safety protocols safety reporting forms applicable during site work.

3. Instructions to Bidder:

1. Before bid submission, it is recommended that the bidder shall inspect the site of work and shall fully acquaint himself about the conditions prevailing at site, availability of facilities, availability of vacant space and suitable location for transport access, the extent of stairs and crane involved in the work (over the entire duration of contract) including local conditions, as required for satisfactory execution of the work and nothing extra whatsoever shall be paid on this account.
2. It shall be deemed that the bidder shall have satisfied himself as to the nature and location of the work, transport access, availability of space for integration work etc. The ITER-India will bear no responsibility for lack of such knowledge and the consequences thereof.
3. The Successful bidder shall be responsible for the true and proper setting out of the work in coordination with the Engineer-in-charge or his authorized representatives and for the correctness of the positions, levels, dimensions and alignments of all parts of the structure and for the provisions of all necessary instruments' appliances and labor in connection therewith.
4. If at any time, during the progress of work, any error appears or arises in the position, levels, dimensions or alignment of any part of the work, the contractor on being asked to do so by the Engineer-in-charge, shall rectify such error to the entire satisfaction of Engineer-in-charge.

The checking by the Engineer-in-charge or his authorized representative shall not relieve the contractor of his responsibility for the correctness of any setting out of any line or level.

5. Facilities available at installation site (3rd floor) for use: Overhead crane (Capacity: 05 ton) and Power points for use of electrical power. Details shall be checked by the bidder at the time of site visit.

List of free issue materials during FAT	
S. No.	Items
1	SS 304 PLC Panel fitted with
2	Service plate
3	Exhaust fan
4	Mounting stand

Table 3: List of free issue materials from ITER-India

List of facilities available during SAT	
S. No.	Items
1	DM Water
2	Overhead crane
3	Lift for material movement
4	Electrical point

Table 2: List of facilities available at ITER-India site

3.1 Precautions to be followed during the site work

1. The contractor is required to take necessary measures to ensure the safety of personnel & equipment. The contractor is fully responsible for the safety of the man, materials & machinery while executing the site work. Please refer to the link https://www.ipr.res.in/documents/safety_protocols.html for safety protocols and reporting forms applicable for IPR/ITER-India lab site.
2. Work should be done only in the presence of ITER-India representative(s).
3. Scratches, dents and tool marks are not allowed on the surfaces, Panels & other equipment in site.
4. The work shall be carried out in such a manner so as not to adversely interfere/or effect or disturb other works being executed in adjacent labs, if any.
5. Any loss/ damages done by the contractor to any existing work or facility at ITER-India Lab building being executed by other agencies shall be made good by him at his own cost and risk.
6. Some restrictions may be imposed by the Institutes security staff etc., on the working and for movement of labor, materials etc. The contractor shall be bound to follow all such restrictions/instructions and nothing extra shall be payable on this account.

3.2 Work Completion

The specified work scope (supply & installation at site) shall be completed within 7 months from the date of placement of purchase order. The site readiness date shall be issued within one month from date of purchase order.

4 Drawings & Detailed Specifications

Detailed drawings: Detailed drawings in annexure-2 consisting of all necessary specifications are attached here with.

	Part-A(II): Scope of Supply & Work, Technical Specifications and Drawings
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4.1 BOQ and technical specifications for fabrication work

S. N.	Component Description		Material Specifications		Quantity	Bidder Compliance
1.	Pipelines & fittings	Line Size: DN 40	Material: SS304 (nonmagnetic grade) for cooling water application Schedule: 40S (Seamless) Fittings: It will include all elbows, flanges, gaskets and complete set of fasteners. Operating Pressure: 6 Bar; Test Pressure: 9 Bar Maximum Temperature: 70 °C		As per lengths mentioned in drawings (Annexure-2)	
		Line Size: DN 25				
		Line Size: DN 15				
2.	Support structure material	C Channel	Material: SS 304 Size: 75mm X 40mm X 5mm		As per lengths mentioned in drawings (Annexure-2)	
		L Angle	Size: 40mm X 40mm X 5mm			
3.	Flow Control Valve	DN 15	Globe type, Flanged end valve, MOC: SS304/ SS316		4 Nos	
		DN 25			1 No	
4.	Ball Valve	DN 15	MOC: SS304	Threaded type	3 Nos	
		DN 25		Flanged end	4 Nos	
				DN 40	Flanged end	
				MOC: SS304, flanged end		2 No
5.	Pressure reducing valve (PRV)	DN 15	MOC: SS304, flanged end		4 Nos	
		DN 25			1 No	
Instrumentation*						
5.	Flowmeter^	Line Size: DN 15 [#]	Please refer table 2, for complete specifications		5 Nos	
		Line Size: DN 25 [#]	Please refer table 2, for complete specifications		2 Nos	
6.	Resistance Temperature Detector (RTD)	DN 15	Please refer table 3, for complete specifications		5 Nos	
7.	Pressure Indicator cum Transmitter (PIT)	DN 15	Please refer table 4, for complete specifications		5 Nos	
8.	Metallic flexible hose	DN 40	Material: SS 304, Flanged end,	2.5 meters	1 No	
				2 meters	1 No	
9.	Cable	2 cores	Please refer table 5, for complete specifications		500 mts	
*Please duly submit the verifiable openly published data sheets of the proposed models along with the bid as a proof of compliance. Bidders are requested to do their market study for technical compliance and cost estimation before proposing a model in their bid.						

	Part-A(II): Scope of Supply & Work, Technical Specifications and Drawings
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^Recommended Makes: Flow meters of well-established & proven makes and models that are complying with the specifications are only allowed. Makes Such as: Krohne Marshall, Kobold, Yokogawa, Honeywell, Emerson or equivalent may be considered.

#Please specify the proposed make and models

Table 4: Component wise specifications for fabrication

4.2 Technical Specifications of Flowmeters

Specification Name	Detail	Required Value	Bidders comment & compliance notes
Make	Specify		
Model	Specify		
Sizing	Type 1	Flow range	~ (6 - 30) LPM
		Line Size	DN 15
	Type 2	Flow range	~ (25 - 80) LPM
		Line Size	DN 25
Measuring Technique	DN 15	Vortex type	
	DN 25	Vortex type	
MOC –Flow Sensor SS 316, Housing - Non-magnetic material, SS 304/ SS316/Die-cast Aluminum with matching fasteners SS 304 or better.			
Display		LCD with backlight or LED display; LPM unit	
Process Connection	DN 15	Flanged end, Class 150, ASME B16.5	
	DN 25		
Nominal Pressure	Operating between	0- 6 Bar(g)	
Maximum Pressure	Must withstand at least	9 Bar(g)	
Temperature		15 to 70 °C	
Accuracy <i>(ITER-India on its own discretion may witness the Calibration test)</i>		±1 % of full-scale flow rate or better	
	Calibration	3- or 5-Point Calibration report to be included.	
Protection		as per IP-65 or better	
Pressure Drop		≤ 0.3 Bar at 100% flow range	
Power Supply		24V Loop power supply preferred	
Current measurement		2-wire method	
Transmitter analog output signal monitoring		4-20 mA, with HART Protocol.	

Table 5: Technical Specifications of Flowmeters

	Part-A(II): Scope of Supply & Work, Technical Specifications and Drawings
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4.3 Resistance Temperature Detector (RTD)

Temperature at inlet and outlet of various thermal load components can be measured using RTD.

Specification Name	Detail	Required Value	Bidders comment & compliance notes
Make / Model	Specify		
MOC	Sensing Element	High purity Platinum wire	
	Wetted part	SS 316	
	Housing & matching fasteners	SS 304	
	RTD insert	SS 304 or SS 316	
	Insulation Material	Mineral (MgO) insulated	
	Type of sensor & Transmitters.	PT1000 4-wire	
RTD Head Assembly	Case & Cover	Die Cast Aluminum	
	Process Connection	½ inch NPT (M)/ BSP (M)	
Thermowell with hole for direct contact	Material	SS 304L or SS 316L	
	Opening for RTD	½ inch NPT (F)/ BSP (F)	
Accuracy		Tolerance Class A	
Repeatability		< ± 0.5%	
Response Time	RTD Element	≤ 7 sec (direct contact)	
Dimension	Stem diameter	~ 3 or 6 mm (3mm preferred)	
	Stem length	60 mm	
Pressure	Must withstand at least 10 Bar(g)	Operating between 0- 6 Bar(g)	
Temperature	Typical Operating range	0 to 100 °C	
Power supply Compatibility		Compatible with 24V DC Loop Power Supply	
Accessories Included (if any)	Specify		
Weight (kg)	Specify		

Table 6: Specifications of RTD

4.4 Pressure Indicator cum Transmitter (PIT)

Pressure available with flowing fluid in pipelines can be measured using pressure indicator cum transmitter.

	Part-A(II): Scope of Supply & Work, Technical Specifications and Drawings
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Specification Name	Detail	Required Value	Bidders comment & compliance notes
Make/Model	Specify		
MOC	Wetted part	SS 316	
	Sensing element	Ceramic/SS 316 with Viton/EPDM sealing	
	housing and matching fasteners	SS 304	
Type of sensor & Transmitters.	Specify		
Process connection		15 NPT(M) insert type	
Display	'transmitter with display type'	4 Digit LED/LCD in Bar(g) Unit	
Nominal Pressure	Operating between	0- 6 Bar(g)	
Maximum Pressure	Must withstand at least	10 Bar(g)	
Temperature		15 to 70 °C	
Accuracy		1.0 % FSD or better	
Repeatability:		0.5 % or better	
Protection		as per IP-65	
Response time		< 1 sec	
Power Supply		24V DC Loop Power supply	
Output signal		4-20 mA	
Accessories	Direct Mounting three-way valve manifold for calibration, maintenance & over range protection purpose		

Table 7: Specification of Pressure indicator cum transmitter

4.5 Cable for instrumentation

Integration of instrumentation with the PLC for the power supply requirement and for acquiring output signals, cable with the below mentioned specifications would be required

Specification Name	Detail	Required Value	Bidders comment & compliance notes
No. of strands/ strand diameter		19/ 0.16mm SPC	
Inner conductor	silver plated copper wire		
Conductor diameter		0.81 mm +/- 0.03 mm	
Diameter of core including insulation		1.17 to 1.37mm	

Thickness of insulation		0.25+/-0.05mm	
No. of cores		2	
Core colors	Different Preferred to identify them separately		
Core insulation	Twisted & Spiral Wrapped and fused PTFE tape		
Insulation rating		3 KV for 1 second, 600V AC continuous, Type E	
Resistance per 100 meters		5Ω or less (at 20°C)	
Filler material/ Isolator	PTFE		
Screening Coverage/ Screening material	with Silver plated Copper	>95%	
Sheath thickness		0.25 +/- 0.05mm	
Sheath color	Grey/White		
Temperature rating		-65 to 200°C	
Standards	JSS 51038/ MIL-DTL-27500H		
Application	Fluid Temperature Measurement		

Table 8: Specification of cable

4.6 Electrical Cabinet/Panel/Box

- A centralized electrical termination Cabinet/box/panel would be required for system, as it reduces the redundant power cabling from LT panel to each of the sensors, simpler cabling from PLC to manifold and provides assurance electrical isolation in case of optimization/maintenance/trouble shooting.
- Contractor should submit all the relevant drawings such as SLD of Power & Instrumentation, GA drawings of the Cabinet/Panel/Box prior to fabrication for ITER-India approval.
- All the Circuit-breakers (MCBs), terminal blocks, cables, cable glands etc., metals tags etc., provided shall be easily accessible and properly rated so as for easy replacement. All the cables (including power, control and monitoring) shall route to panel from field instruments. All the cables (power and control) selected shall be properly rated to prevent excessive heating and all the cables shall have proper indication with ferrules.
- All the terminations (electrical cables entries) points shall be easily accessible from top/bottom sides to reduce the complexity while operation, alteration and maintenance activities.
- Suitable screw type terminal blocks shall be used for power and instrumentation cables terminations and same shall be marked clearly. (For example, at Input: as R, Y, and B, N, & E and for respective names for respective field instruments.)
- All wiring shall be neatly secured in position and adequately supported. All the wires and cables used shall be fire retardant low smoke (FRLS) as per IS1554 and IS 694 with latest amendments

and they shall be properly rated to prevent excessive heating. Proper indication on cable shall be provided for all the cables.

Name	Part number	Total
Stand. sectional Rail 35mm, Length 483mm	6ES5710-8MA11	1
ET 200SP, IM155-6PN ST	6ES7155-6AU01-0BN0	1
ET 200SP, Busadapter BA 2xRJ45	6ES7193-6AR00-0AA0	1
ET 200SP, AI 4XI 2-/4-Wire ST, PU 1	6ES7134-6GD01-0BA1	5
BaseUnit Type A1, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	1
BaseUnit Type A1, BU15-P16+A0+2B/T	6ES7193-6BP00-0BA1	5
ET 200SP, AI 8xRTD/TC 2-Wire HF	6ES7134-6JF00-0CA1	1

Table 9: Proposed Siemens Make Components for PLC Integration in Panel

5. Prefabrication & Quality Control

- ✓ Random inspection may be organized by ITER-India for inspecting the quality of procured material/components and observation of fabrication processes for SS Structure & Pipe Assembly.

6. Factory Testing, Pre-dispatch Inspection & Dispatch Clearance

- ✓ Supplier has to demonstrate assembly of all components and assembled pipes are to be **Hydro tested at 9 Bar test pressure**.
- ✓ A pre-dispatch Inspection may be conducted by ITER-India representative for witnessing the factory tests. It is preferable to conduct basic flow tests at factory to ensure that the flow meters are functioning properly before dispatch. However, if such tests are not possible at factory the same will be done at ITER-India site.
- ✓ A dispatch clearance note will be issued by the purchaser after successful completion of the pre-dispatch inspection. Supplier shall initiate the delivery only after receiving the dispatch clearance note from the purchaser.

S/N	Components	Type of Test	To be witnessed	Documents Required	Bidders comment & compliance notes
1	Piping	Hydro Test	Yes	Test Report	
		Material	--	MTC (NABL approved)	
2	Fitting	Hydro Test	Yes	Test Report	
		Material	--	MTC (NABL approved)	
3	Structural Material	Material	--	MTC (NABL approved)	
4	Valves	Hydro Test	Yes	Test Certificate &	
				Inspection report	

	Part-A(II): Scope of Supply & Work, Technical Specifications and Drawings
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		Specification		OEM data sheet	
5	RTD (Resistant temp. detector)	Physical Inspection	These tests will be conducted at ITER-India site, in case, facility isn't available at supplier's end.	Test Certificate & Calibration Certificate	
		Specification		OEM data sheet	
6	Flow Indicator cum Transmitter	Physical Inspection		Test Certificate & Calibration Certificate	
		Specification		OEM data sheet	
7	Pressure Indicator cum Transmitter	Physical Inspection		Test Certificate & Calibration Certificate	
		Specification		OEM data sheet	

Table 10: List of tests to be performed for respective components and List of documents to be submitted by supplier

7. Final Acceptance

- ✓ The properly fabricated and assembled structure of Mini Flow Test & Calibration Manifold will be inspected and tested by ITER-India for hydrostatic pressure test for 9 Bars for any leakages and flow tests to verify the performance of the instruments. If found satisfactory, the final acceptance will be given.

8. Bid Submission

- ✓ Bidder has to study all the drawings thoroughly and incase of any query/question, it should be sought from ITER-India before bid submission.
- ✓ Bidder has to fill up the technical compliance sheet as per Table-2 to Table-6 and Table-8 and submit along with the bid and incase of any query/question, it should be sought from ITER-India before bid submission.
- ✓ As a proof of compliance, the bidder has to submit the verifiable OEM published data sheet for the proposed Flow-meters. Bidders are requested to do their market study for technical compliance and cost estimation before proposing a make & model in their bid. Authenticity of the data sheets that cannot be verified through the OEM's web site may not be considered for evaluation and such bids may be rejected. Bidders are requested quote good quality reliable and reputed products meeting all the technical specifications only.
- ✓ As a confirmation that bidder has gone through the drawings and understood the full scope of work, signed & stamped copies of all the drawings are to be submitted along with the bid.
- ✓ Bidder has to fill the details of make and model for the particulars of below table

S. No.	Particulars	Size	Make/ Model
--------	-------------	------	-------------

1	Pipelines & fittings	DN 15	
		DN 25	
		DN 40	
2	Support structure material	C Channel	
		L Angle	
3	Flow Control Valve	DN 15	
		DN 25	
4	Ball Valve	DN 15	
		DN 25	
		DN 15	
5	Pressure reducing valve (PRV)	DN 15	
		DN 25	
6	Metallic flexible hose	DN 40	
7	Cable	2 Core	

Table 11: Particulars/items make and model

Annexure-2: List of drawings & schematics

S. No.	Description	Page No
1	Supply Manifold-3D view	1
2	Supply frame (Sf)	2
3	Lateral C Channel (F1) + longitudinal C channel (F2) + Vertical L Angle (F3)	3
4	Longitudinal L Channel (F4) + Lateral L angel (F5) + Branch support (F6)	4
5	Supply Mains (Sm)	5
6	1" Supply Branch (S5) and ½" Supply Branch details (S1, S2, S3, S4)	6
7	Return Manifold-3D view	7
8	Return frame (Rf)	8
9	Lateral C Channel (F7) + longitudinal C channel (F8) + Vertical L Angle (F9) + Branch Support 1 (F13)	9
10	Longitudinal L Channel (F10) + Lateral L Channel (F11) + L Support (F12) + Branch support 2 (F14)	10
11	Returns Mains (Rm)	11
12	1" Return Branch (R5) and ½" Return Branch details (R1, R2, R3, R4)	12
13	1.5" Supply Header	13
14	1.5" Return Header	14
15	Frame reinforcement support	15
16	Angle reinforcement support	16

Table 12: List of drawings for the project

Bidders Signature		
Name of the Signatory & Title	Name	Title
Bidder's Official seal		
Place & Date	Place	DD-MM-YYYY

CAD schematic for understanding the work-scope

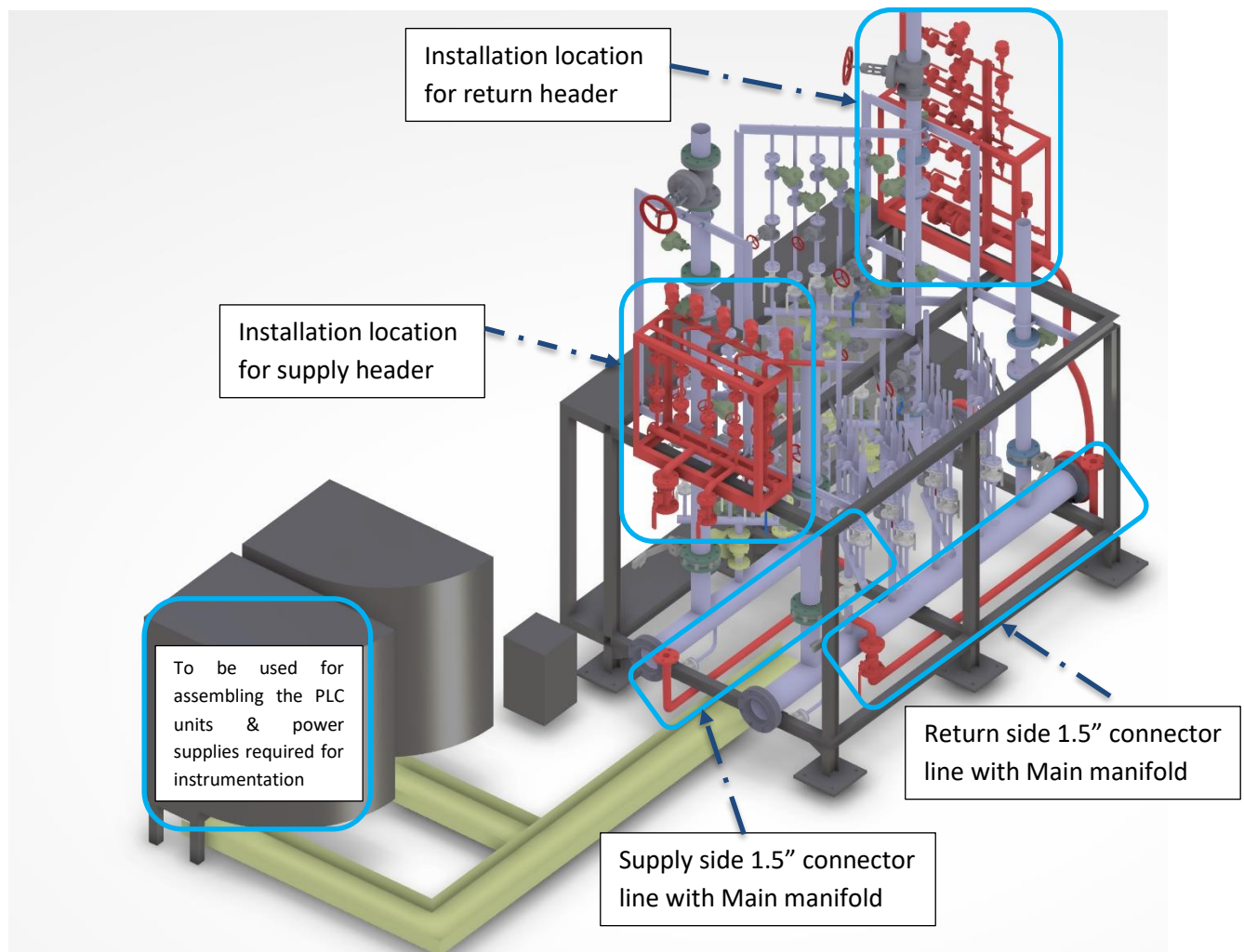


Figure 1: Integrated view of fabricated cooling channels (mini cooling manifold) with Cooling Manifold

Scope of supply: Red coloured model in assembly also shown in isometric view separately.

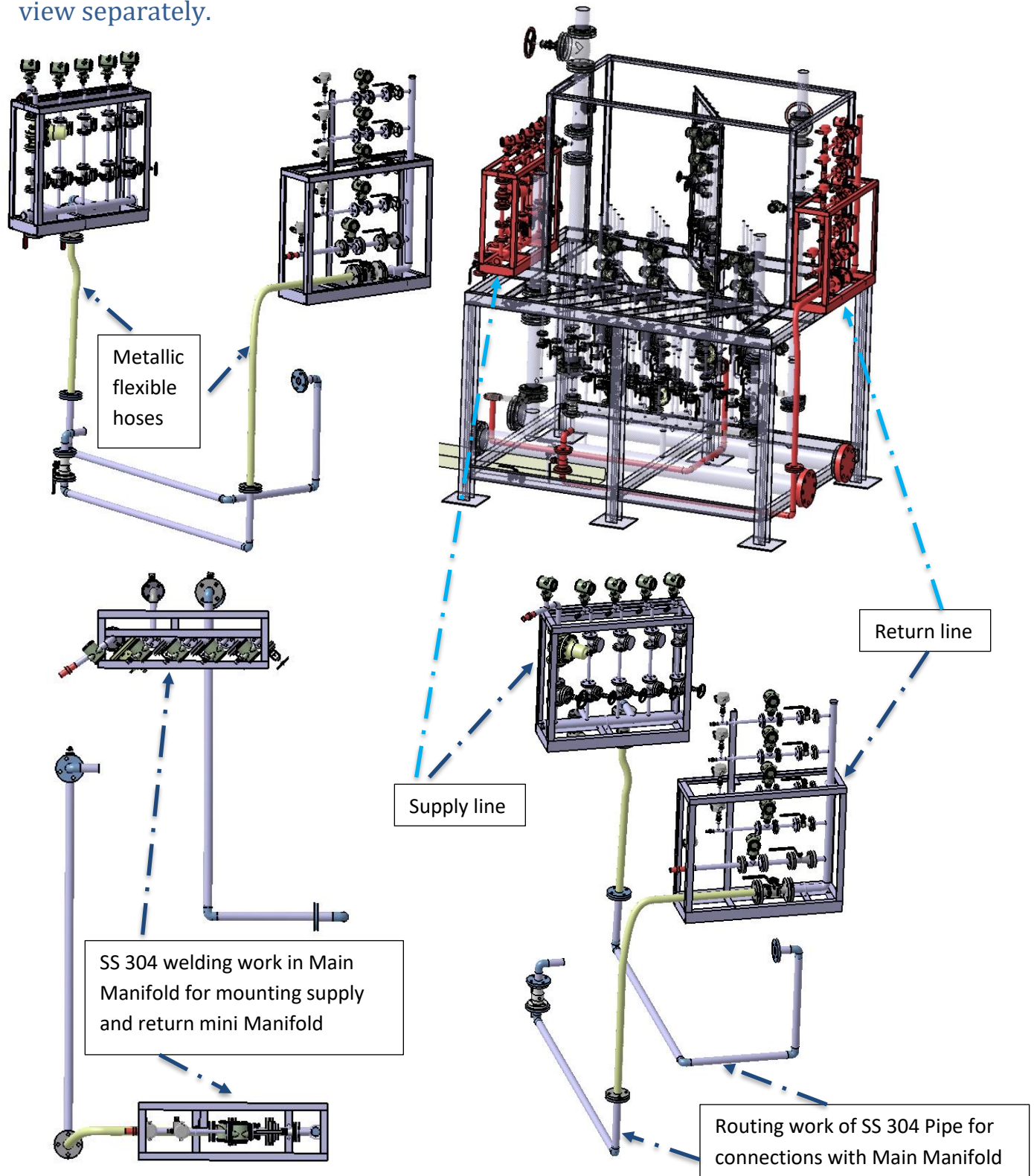


Figure 2: Identification of locations for integration

Annexure-2: List of drawings & schematics
