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1. Introduction, and scope

a) Introduction

This document talks about the hydraulic tubing activity of a Heat exchanger test rig to be carried out at CMTI, Bangalore.

b) Vendor scope of Work and Supply

1. Hydraulic tubing shall be realized as per the tubing layout shown in Annexure 1.
2. Pressure testing of all the tubes, fittings to 1.5times its respective working pressure.
3. Flushing of the tubes to remove slags/burrs/debris before and after welding.
4. All the necessary fixtures and tooling's for bending, cutting, and deburring.
5. All necessary fittings and tubes involved in the tubing shall be the vendor's scope and the Material of construction (MOC) of the fittings shall be SS 304.
6. 37° flared fittings to be used (JIC 37°) with necessary precautionary measures taken to prevent thread galling (such as coating on fittings).
7. The vendor shall submit test reports for pressure testing, DP test, Material characterization of the tubes and fittings. CoC shall be submitted.
8. Thermal insulation to be provided on all tubes and fittings, all line items such as reservoirs (except thermic fluid, valves, filters) etc.
9. Supply of manifold as per fig 4-8 of annexure -1. Manifolds should be thoroughly deburred before assembly.
10. Labour work in achieving tubing connections as per fig 1-3 of annexure 1 at CMTI.

c) CMTI scope

1. Hydraulic tube flaring tool with dies of 1 inch and 1.5 inch tube sizes shall be provided by CMTI for use. The flaring tool available at CMTI is "Parker make, KARRYFLARE (model)".
2. All Hydraulic elements (Pumps, motors, tanks, valves etc.) except tubes, flanges, fittings and ball valves.

2. Tubing specifications

1. The hydraulic tubing for the Heat exchanger test rig is to be carried out as follows
   i. The tubing layout schematic at test rig level, with tube lengths and sizes, is mentioned in Annexure-1.
2. All tubing connections (as per Annexure-1) shall be as per JIC 37° Flare fittings.
3. MOC of all tubings shall be Seamless SS304L conforming to relevant international standards.
4. The MOC of the fittings shall be SS304 with necessary precautionary measures taken to prevent thread galling.
5. The MOC of the Ball valve shall be SS 304.
6. CMTI representatives shall witness pressure testing and flushing of the tubes.
7. Flushing and pressure testing of tubes should be carried out by using the vendor's hydraulic power pack.
8. Flushing the pipes at 7 m/s velocity shall be carried out, ISO VG oils can be used for flushing the pipes.

9. The factor of safety for all the tubes shall be 4.
10. Internal and external Deburring of tubes after cutting, and welding, shall be carried out along with inspection reports.
11. Certified welder shall only carry out all the welding activity.
12. Vendor shall provide suitable stands with tube clamp supports wherever necessary (annexure - 1).
13. Bores of the pipes should be free from scales, slag, or any contaminants. Internal surface roughness value of the pipes shall not exceed Ra value of 1.6 microns.
14. All tubing's shall be cleaned, and free from burrs. Internal surfaces shall be free from all burrs after they are welded to the flanges.
15. All tubes shall be numbered accordingly for identification.
16. Suitable bending radius shall be considered and the bulging of tubes at any place will not be accepted.
17. If any deviation of tubing layout from the proposed layout, vendor shall take prior compliance from CMTI.

3. Documentation:

1. Material characterization certificate of all the tubes w.r.t size, source, and MOC used shall be provided in 2 sets.
2. A document for tube numbering and connectivity details for tracing and identification shall be supplied.
3. Certified welder shall only carry out all the welding activity and his certificate shall be attached along with DP reports.
4. DP test for weld joints
5. Specifications / catalogues.
6. Test report for proof pressure of all the fittings and tubes.
7. Certificate of Conformance (wherever applicable).

ANNEXURE - 1

Tubing layout of test rigs along with probable Bill of Materials for fittings (JIC 37 deg flare, BSPP, and BSPT), ball valves & Tubes

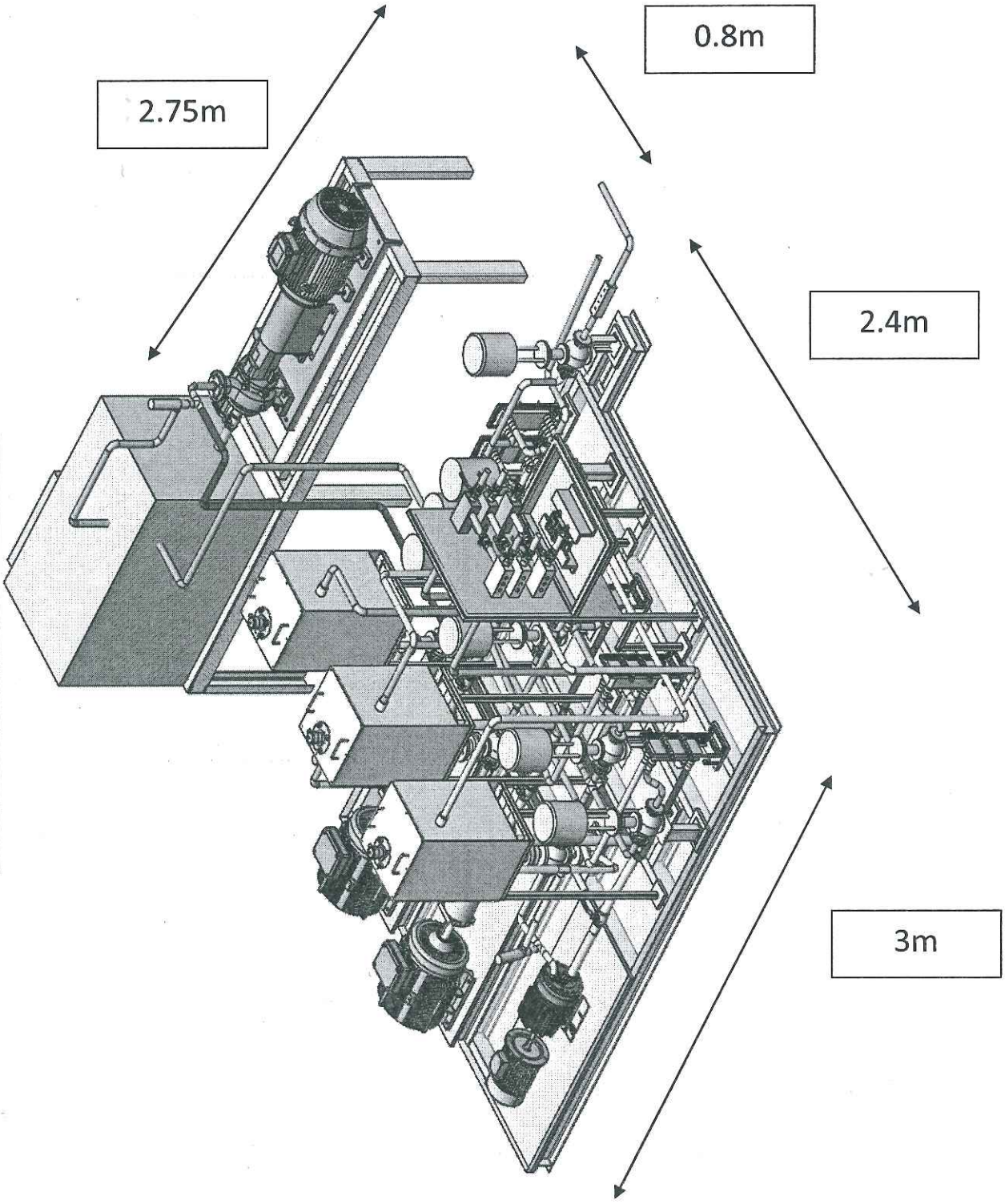


Figure 1.a (OVERALL LAYOUT

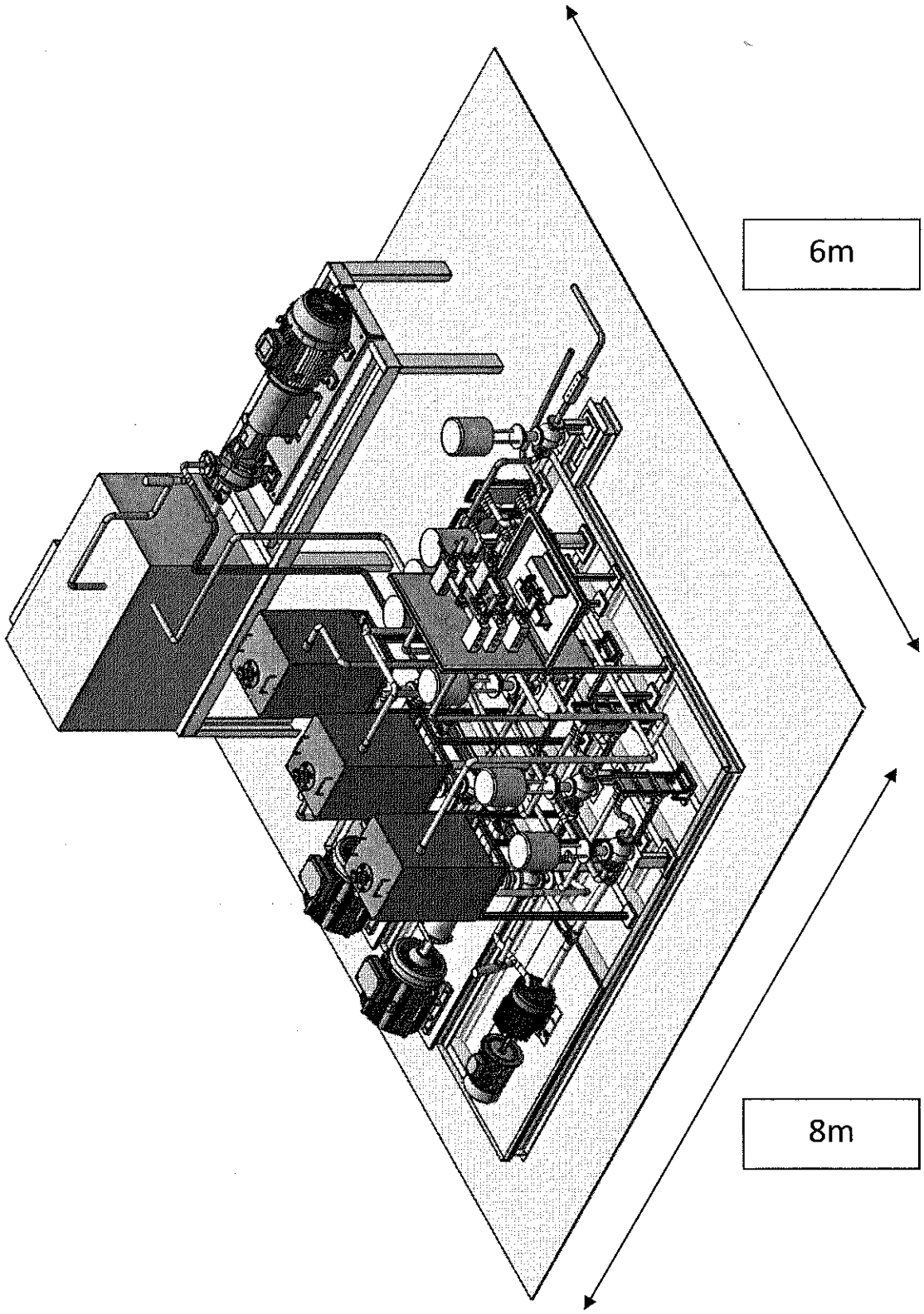


Figure 1.b (OVERALL LAYOUT)

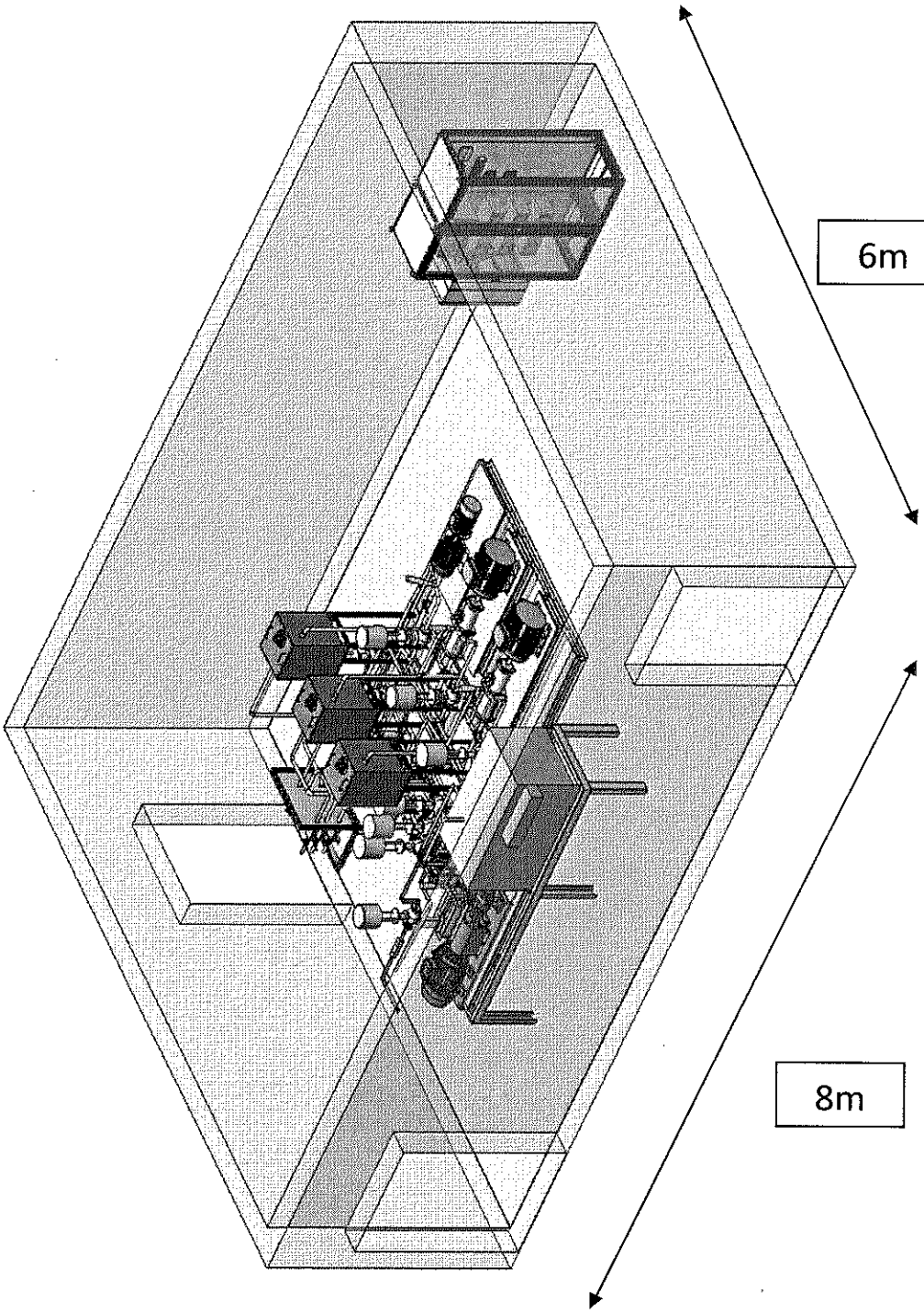


Figure 1.C (OVERALL LAYOUT)

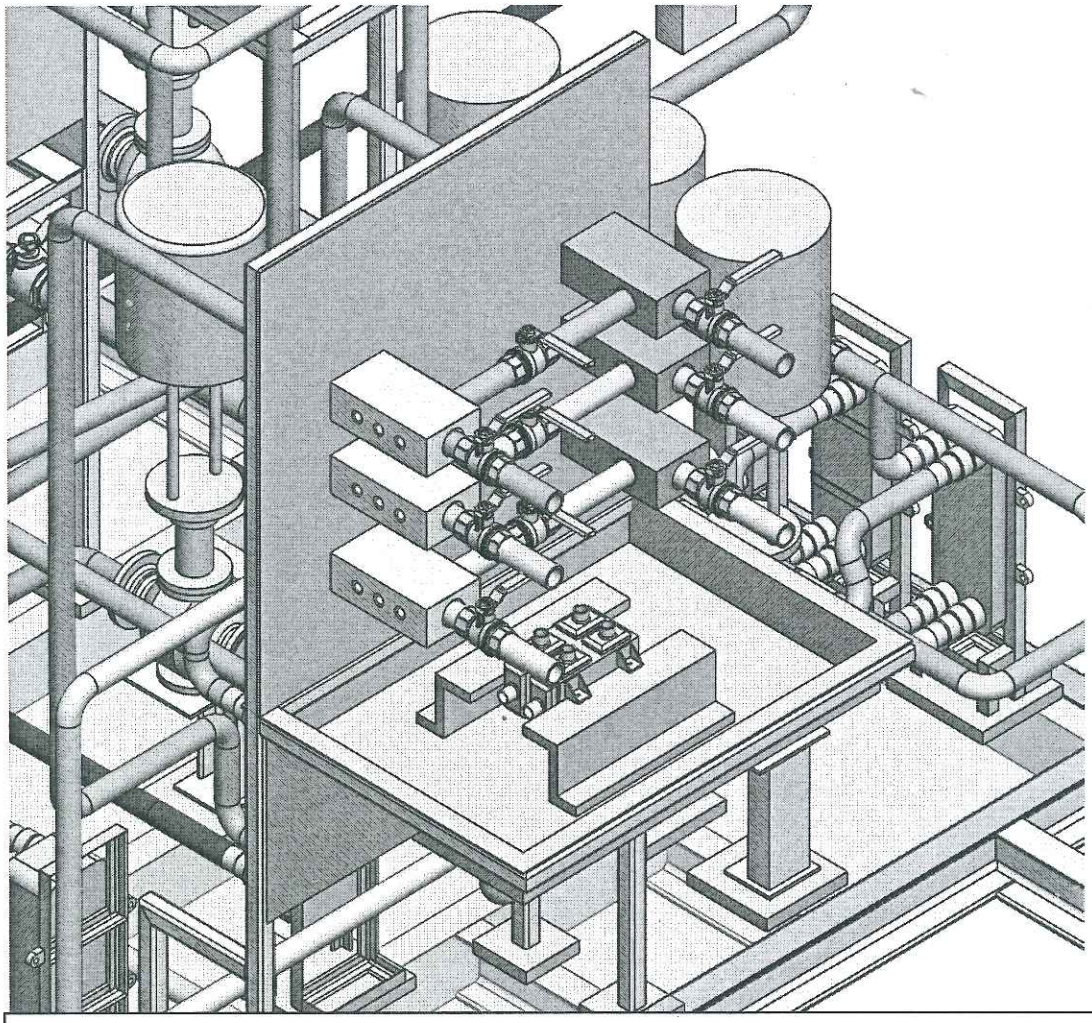


Figure 2 . Close up view of manifold block arrangement

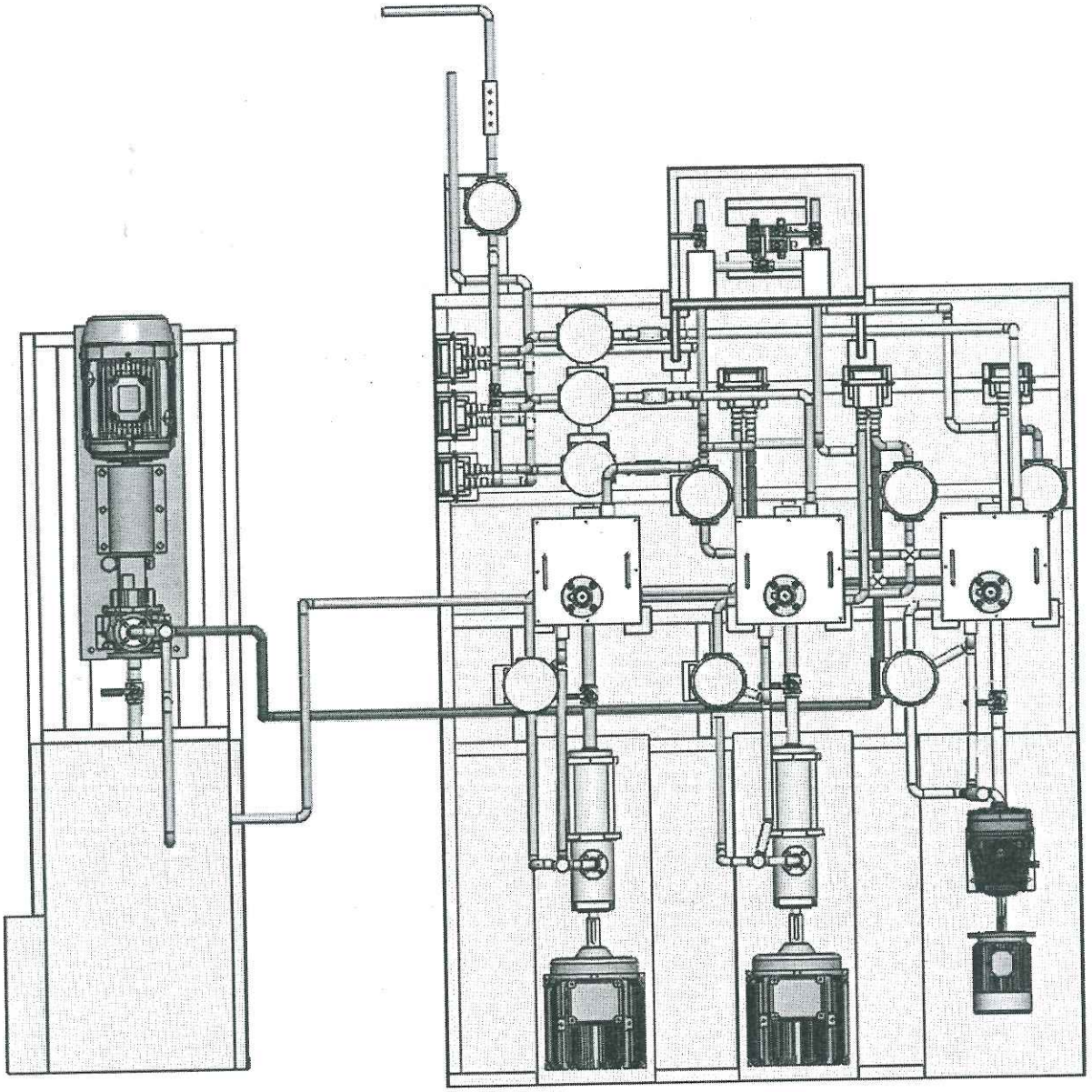


Figure 3. Top view of layout

System 1: 250deg C (Max), 10bar, 150lpm (max)
System 2: 180deg C (Max), 60bar, 120lpm (max)
System 3: 150deg C (Max), 70bar, 160lpm (max)
System 4: 120deg C (Max), 45bar, 70lpm (max)

Table 1: Bill of Materials (BoM) for Tubes, Fittings and Valves

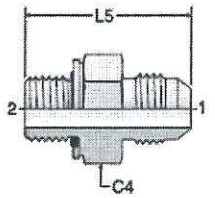
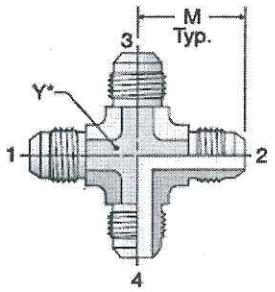
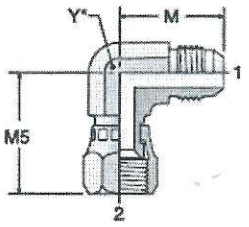
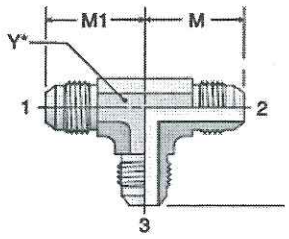
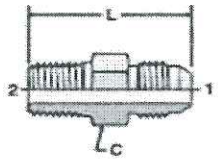
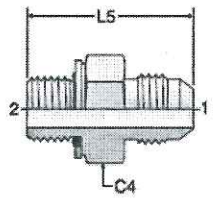
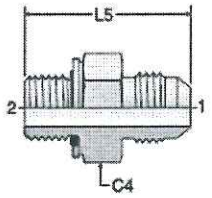
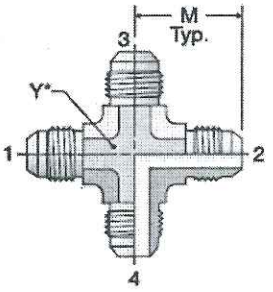
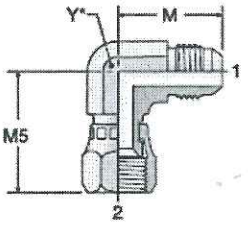
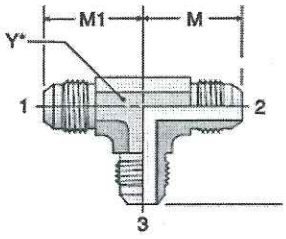
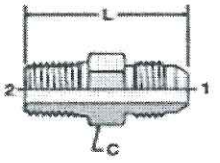
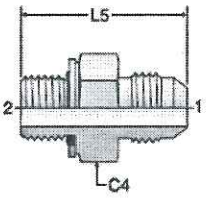
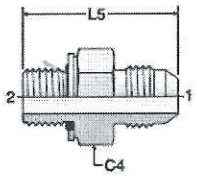
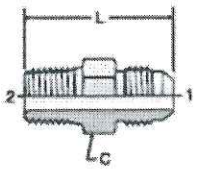
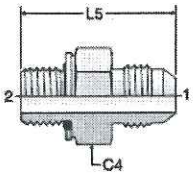
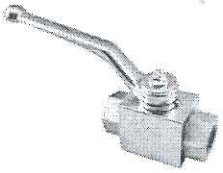
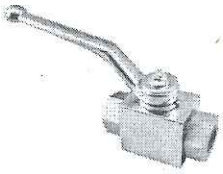
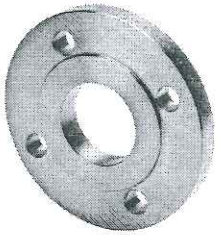
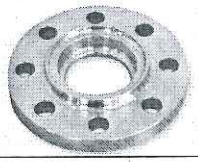
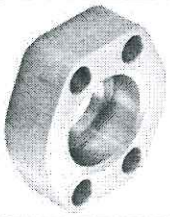
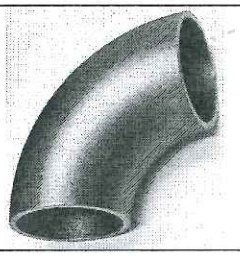
Sl.No	Description	1	2	3	Qty	Image
1	Straight connector	JIC 1"	G 1"	-	60	
2.	Union Cross	JIC 1"	JIC 1"	JIC 1", 4 - JIC 1"	3	
3	Swivel Elbow	JIC 1"	JIC 1"	-	10	
4	Equal Tee	JIC 1"	JIC 1"	JIC 1"	10	
5	ADAPTOR	1.5" JIC	1.5" BSPT	-	1	
6	Straight connector	JIC 1.5"	G 1.5"	-	12	

Table 1: Bill of Materials (BoM) for Tubes, Fittings and Valves

Sl.No	Description	1	2	3	Qty	Image
1	Straight connector	JIC 1"	G 1"	-	60	
2.	Union Cross	JIC 1"	JIC 1"	JIC 1", 4 - JIC 1"	3	
3	Swivel Elbow	JIC 1"	JIC 1"	-	10	
4	Equal Tee	JIC 1"	JIC 1"	JIC 1"	10	
5	ADAPTOR	1.5" JIC	1.5" BSPT	-	1	
6	Straight connector	JIC 1.5"	G 1.5"	-	12	

7	Straight connector	1" JIC	G1.5"	-	28	
8	ADAPTOR	1" JIC	1" BSPT	-	1	
9	Straight connector	1" JIC	G 3/4"	-	6	
10	Collar/ sleeve fitting	G 1"	G 1"	-	8	
11	Ball Valve	G 1"	G 1"	-	10	
12	Ball Valve	G 1.5"	G 1.5"	-	3	
13	Flange	ANSI 150RF			10	
13	Flange	ANSI 600RF			12	
14	Flange	ANSI 300RF			3	

15	Flange	SAE 1.5"	2	
16	Flange	GAS 1.5"	2	
17	SS Tube (SS 304L)	1 inch tube with 3.56mm thick (Schedule-40)	75 mts	
18	SS Tube (SS 304L)	1.5 inch tube with 2.77mm thick (Schedule-10S)	12 mts	
19	GI pipe	1 inch	30 mts	
20	GI pipe	½ inch	10 mts	
21	Manifold	As per figure 4	02	
22	Manifold	As per figure 5	03	
23	Manifold	As per figure 6	03	
24	Manifold	As per figure 7	01	
25	Manifold	As per figure 8	01	
26	Weld able elbow	1" tube	20	

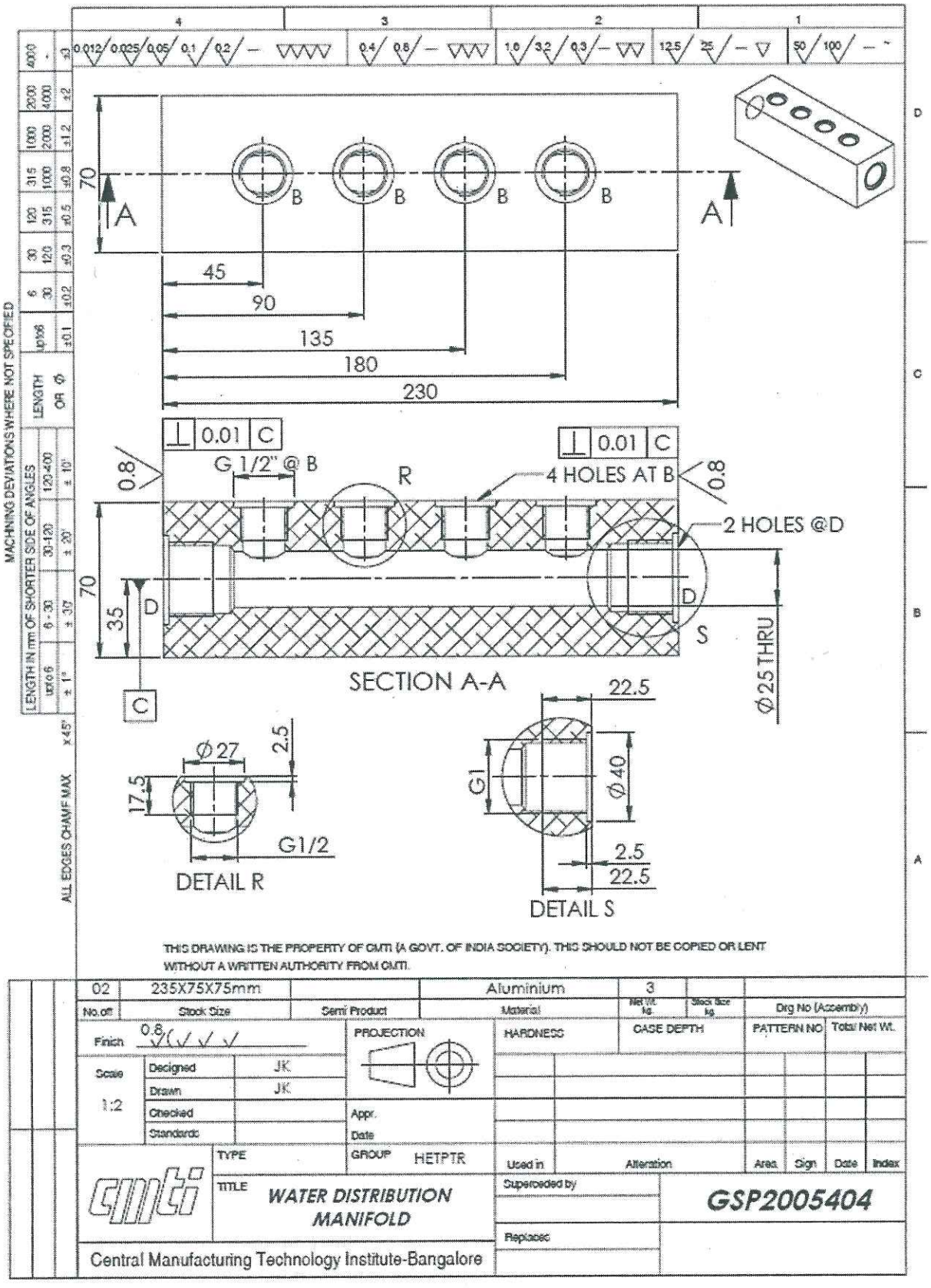


Fig4: Cold water distribution manifold

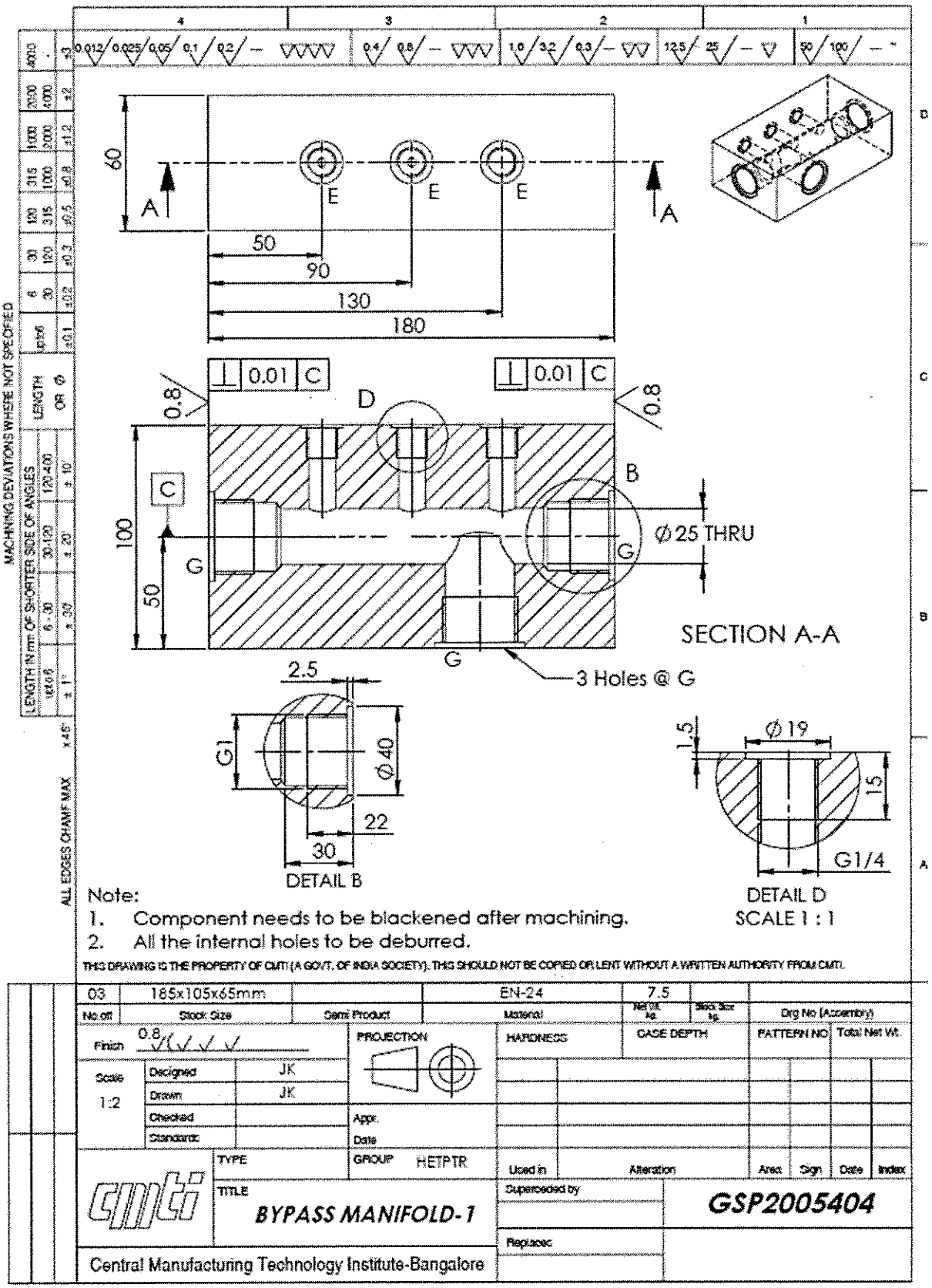


Fig5: Bypass Manifold -1

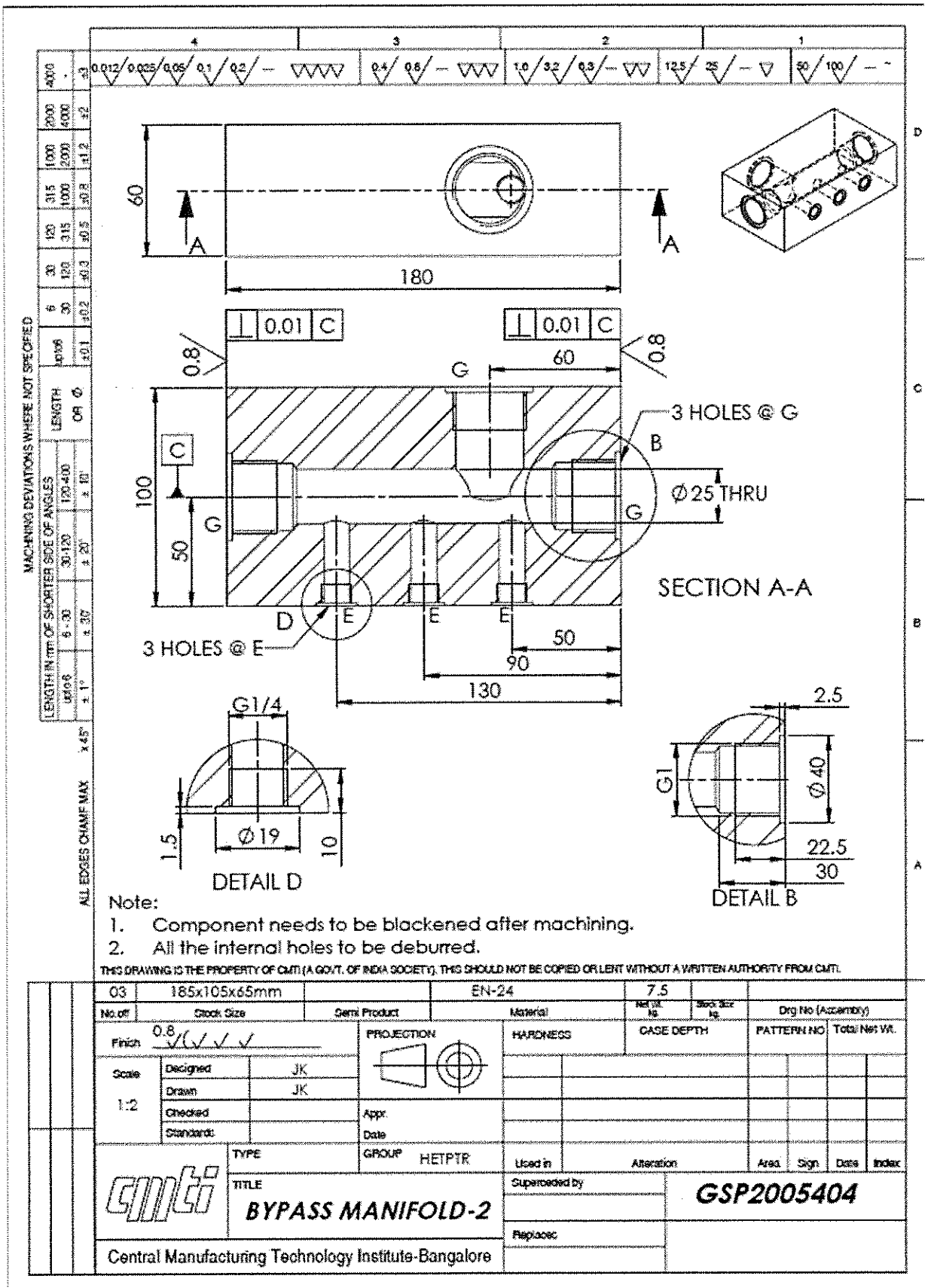


Fig6: Bypass Manifold -2

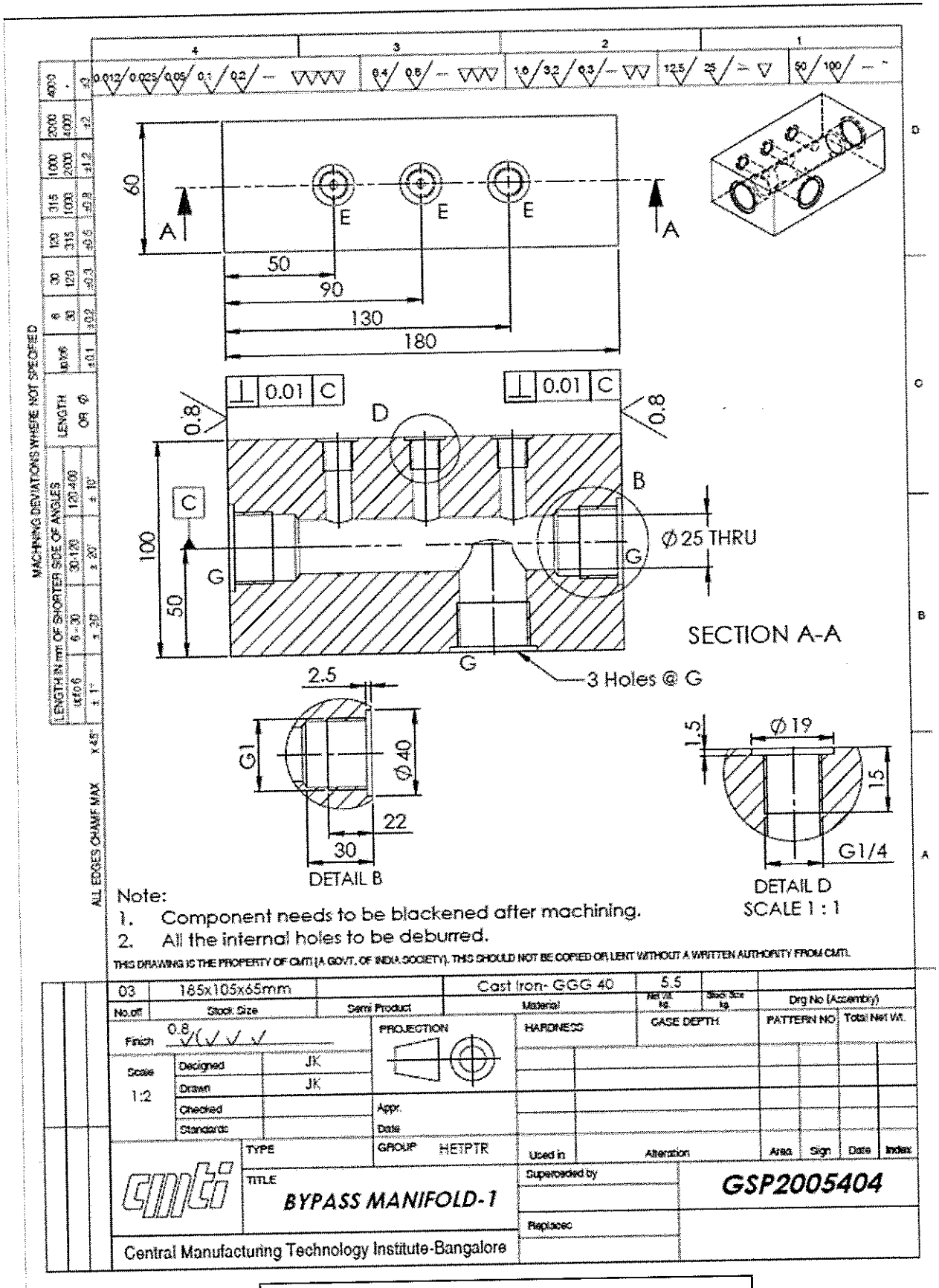
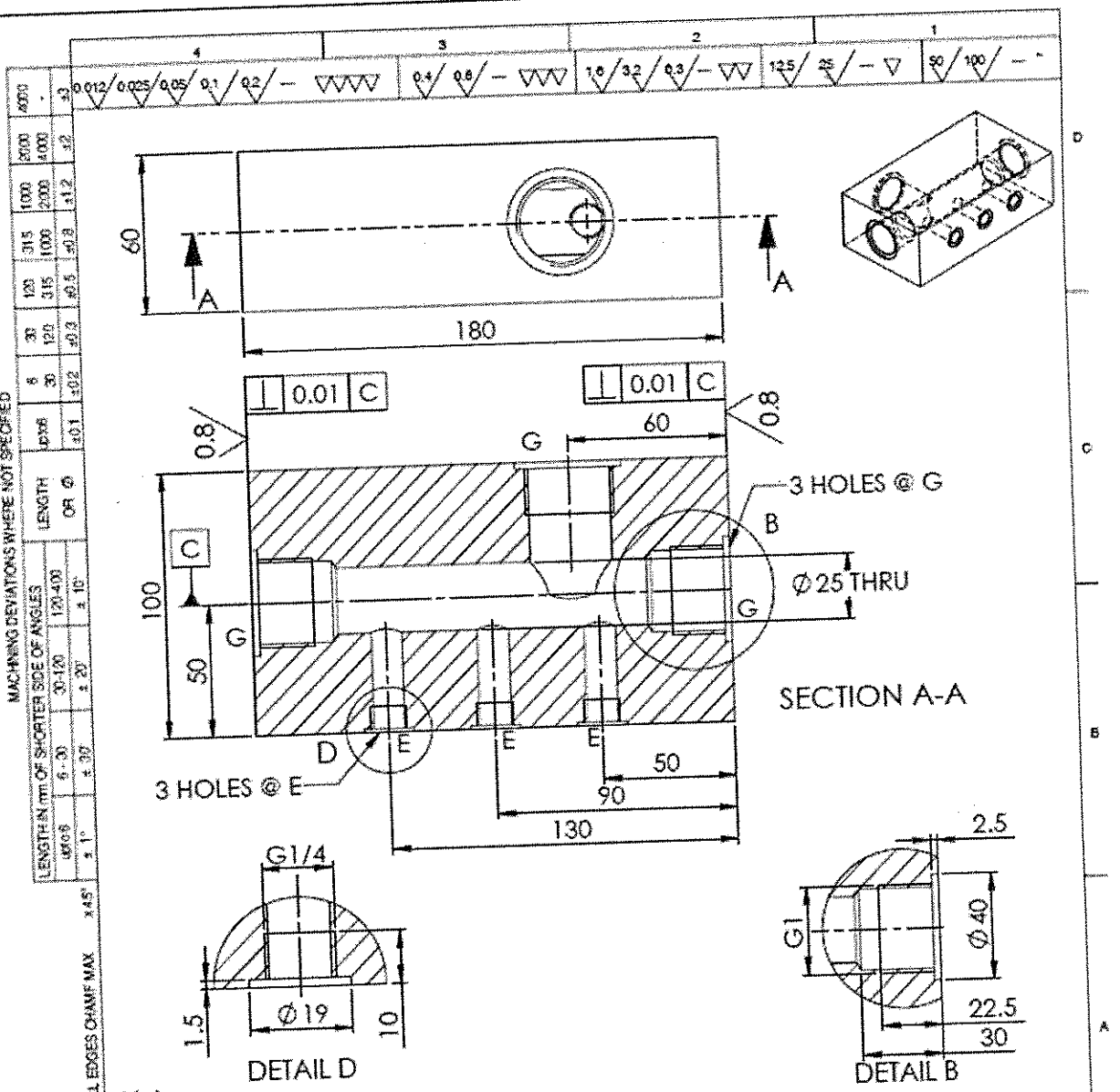


Fig7: Bypass Manifold -1 (GGG 40)



Note:
1. Component needs to be blackened after machining.
2. All the internal holes to be deburred.

03	185x105x65mm		Cast Iron - GGG 40	5.5		Drg No (Assembly)
No.of	Stock Size	Semi Product	Material	Rej./A kg	Stock Size kg	PATTERN NO / Total Net Wt.
Finish 0.8		PROJECTION	HARDNESS	CASE DEPTH		
Scale 1:2	Designed JK / Drawn JK / Checked / Standards	Appr. / Date				
TYPE	GROUP HETPTR	Used in	Alteration		Area / Sign / Date / Index	
TITLE BYPASS MANIFOLD-2		Superseded by		GSP2005404		
Central Manufacturing Technology Institute-Bangalore		Replaces				

Fig8: Bypass Manifold -2 (GGG 40)

ANNEXURE -2

Special Terms and Conditions for the procurement of "Design, Development & Commissioning of Hydraulic Tubing"

This tender shall be based on a two-bid system, which is a technical bid and commercial bid.

1. **Bidder's Qualification Criteria**
   1.1 Technical/Work Experience Criteria: Bidders should have the necessary tubing equipment for carrying out the work, such as bending, flaring, cutting, deburring, etc.
   1.2 Preference shall be given to the bidders who have been certified in relevant International/aerospace QMS (ISO 9001/AS 9100) certification.

2. **Documentation & Responsibilities**
   2.1 In response to this RFB, the bidder shall submit the technical compliance matrix (annexure-3) covering all the requirements specified, clearly stating how the technical specification requirement meets or exceeds the proposed tubing design /equipment.
   2.2 Bidders shall be responsible for integrating and testing the complete tubing at CMTI as an acceptance criterion.

3. **Other Terms and Conditions**
   3.1 Components and materials traceability.
   3.2 Excess of tubes and fittings that are unused after completion of the tubing activity shall be submitted to CMTI.

ANNEXURE -3
Technical Compliance matrix

Availability of Tubing equipment for Stainless steel (SS 304) seamless tubes				
Sl. No	Description	Compliant	Non compliant	Remarks
1	Tube Bending fixtures			
2	Cutting and deburring (internal and external)			
3	Welding of SS tubes			
5	Pressure testing of tubes to 1.5 times working pressures.			
6	Flushing of tubes with 7m/s			

To be filled by vendor.

Sl. No	Description	Make	Specification	Remarks
1.	SS 304L Seamless Hydraulic Tubes			
2.	SS 304 hydraulic Fittings (all sizes)			
3.	SS 304L Weldable flanges			