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CORRIGENDUM / ADDENDUM

Tender No. NAL/PUR/STTD/405/20-Z-G
Tender ID: 2021_CSIR_81935_1 Dated 12-Jul-2021

In continuation of CSIR-National Aerospace Laboratories Tender No. NAL/PUR/STTD/405/20-Z (G) Dated 12-Jul-2021 for **"Procurement of Brake Manifold"** the Chapter 4 enclosed with this corrigendum / addendum may be considered for Pre-Bid Meeting and Submission of Quote instead of Chapter 4 appended in the Tender document.

Other clauses of the bidding document remain unchanged.

Sr. Controller of Stores and Purchase
For and on behalf of CSIR

Chapter 4
Specifications and Allied Technical Details for Brake Manifold

4.1 End Use:

SARAS MK II Aircraft

4.2 Detailed Specifications (including the list of spares, if any)

4.2.1 Specification of Brake Manifold

Table 4-1 Brake Manifold specifications

1.	End Use	19 Seater Commuter Type SARAS MK II Aircraft (with FAR 23 Type Certification)
2.	Type	Pressure modulating type Digital Anti-Skid based Brake Management System (BMS)(Off –The-Shelf (OTS))
3.	Location of the Brake Manifold in the Aircraft	Blister Fairing (Non-controlled pressure location & Non-controlled Temperature zone)
4.	Applicable Regulatory and Certification Documents	Shall meet FAR-23 amendment 23-64 performance-based regulations. The prescriptive provisions within previous latest amendments of FAR-23, where applicable, may be used.

5.	Description	**a)** The brake manifold shall include a shut-off valve and two servo valves. The shut-off shall be in ON/OFF position based on the controller command. **b)** All valves shall have two input control channels (preferably PWM controlled or current controlled), for independently controlling either through Main controller or Standby controller. Provision for Pressure switch (preferably 4 poles) to be provided in the brake manifold. **c)** Each servo-valve connected to the LH/RH brake assembly shall continuously modulate the outlet pressure based on the controller input commands.
6.	Architecture	Required Brake manifold architecture is shown In Fig.1.0
7.	Fluid type	MIL-PRF-5606H / MIL-PRF 83282 or Equivalent
8.	Altitude Requirement	Maximum flying altitude is 30000 feet. Brake manifold is required to be operational till 15000 feet, to support high altitude Landings
9.	Supply pressure	207 bar (g)
10.	Return pressure	2 to 3 bar(g)
11.	Proof pressure	310.5 bar
12.	Burst pressure	517.5 bar
13.	Maximum degree of contamination	Up to class 10 (NAS 1638)
14.	External leakage	Nil
15.	Desired maximum brake manifold outlet pressure during Anti-Skid operation	75 bar (g) (Indicative)
16.	Desired maximum brake manifold outlet pressure during Direct Braking operation	Closer to supply pressure of Brake Manifold

17.	Typical maximum flow rate requirement during anti-skid operation (brake pad fully worn out condition)	3 to 4 LPM
18.	Desired maximum pressure output during direct braking mode	Same as input supply pressure with minor losses
19.	Physical Dimensions	To be Specified by OEM
20.	Electrical Input details	Normal supply 28V DC. Voltage range 18V to 32.2V DC (Abnormal Voltage Limits). Electrical connector pin details to be provided by the OEM. (Connector should be preferably of the D38999 Series 3 type) OEM shall specify whether Servo-valve input electrical interface shall be Pulse Width Modulation (PWM) control (preferable by NAL)/Current control type. If it is current control, rated current shall be typically of the order of 50 mA
21.	Product Support	The proposal shall include assurance of maintenance and spares support for the product during the next 30 years, the aircraft is expected to be in service.

Note: OEM shall provide Mechanical/Electrical/Control related performance data for all the sub-components (Mainly for Servo-valves and Shut-off valve)

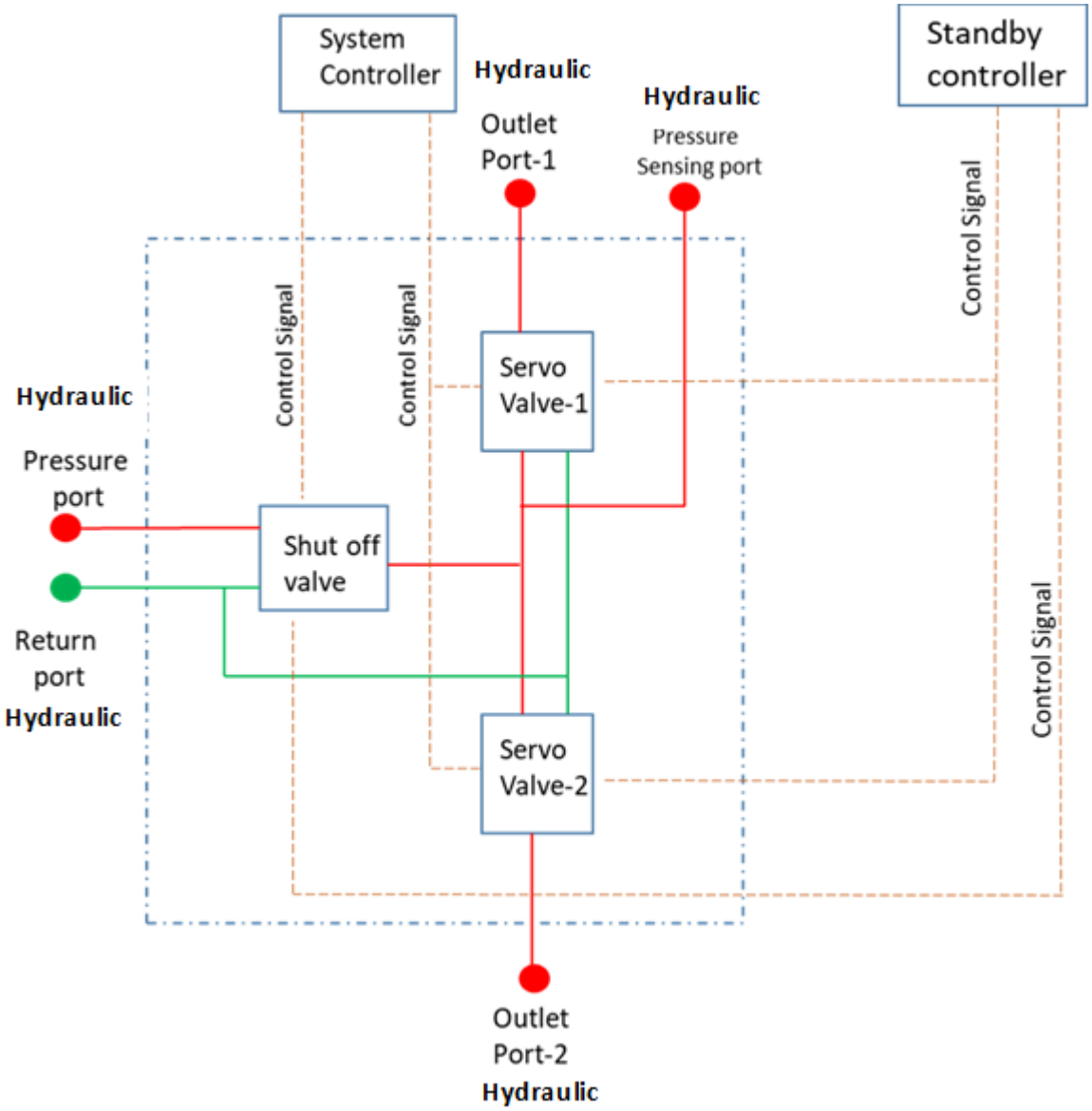

Figure 1: Required Brake Manifold Architecture

4.2.2 Design Requirements

1) LRU should have no operational limitations for the proposed flight envelope.

2) Ease of installation and removal of Hydraulic System LRU'S with minimum attachment points to the structure.

a) Weight Requirements

The typical weight of component of the Brake Manifold should be within 2.75 Kg (Dry).

b) Certification Requirements

Brake Manifold should comply with FAR 23, Amendment 64 based on FAR 23-63 regulations with applicable advisory circulars as on date and other requirements specified in this document.

c) Environmental Qualification Requirements:

Brake Manifold shall be qualified up to 15,000 ft altitude in **functional-mode**
Brake Manifold shall be qualified up to 30,000 ft in **non-functional** mode

Brake Manifold shall be qualified as per RTCA-D0-160G, as per the detailed sub-categories mentioned below in Table 1

Table- 1: RTCA-D0-160G Environmental conditions for Brake Manifold (Comprising of Servo Valves and Shut OFF Valve) Qualification with list of applicable sub-categories

Sr. No.	RTCA Section No	Item Description	Category
		Location	Blister fairing
		LRU name at location	Brake Manifold
1	4	Temperature and altitude	Category C2*
		Operating Low Temp. (deg C)	-55**
		Operating High Temp. (deg C)	+70
		Short-Time Operating Low Temp. (deg C)	-55**
		Short-Time Operating High Temp (deg C)	+70
		Ground Survival Low Temperature (deg C)	-55**
		Ground Survival High Temperature (deg C)	+85
		Altitude Test*	Temp: Ambient Equipment 'ON' Pressure corresponding to 35000 ± 100 ft (23.84 kPa or 7.04 in Hg, absolute)
		Decompression Test	Not Applicable
		*** Aircraft altitude may be limited to 30000 ft instead of 35000 ft, as required for Category C2.** **** Operating Low Temperature, Short-Time Operating Low Temperature and Ground Survival Low Temperature for the equipment may be limited to -45 deg C, as the aircraft maximum altitude is restricted to 30000 feet.**	
2	5	Temperature Variation (A minimum of two cycles shall be accomplished)	Category B Temp. Variation 5 deg C per minute
3	6	Humidity	Category B
4	7	Operational Shock and crash safety	Category B

		Up: 3.0g; Forward: 9.0g; and Side (Left & Right) 4.5g for the specified orientation by OEM	
5	8	Vibration	Category S, Test Curve L
6	9	Explosive atmosphere	Category Zone I Category H
7	10	Water proofness	Category Y
8	11	Fluids Susceptibility	Category F
9	12	Sand and Dust	Category D
10	13	Fungus Resistance	Category F
11	14	Salt Fog	Category S
12	15	Magnetic Effect	Category C
13	16	Power Input	Category B
14	17	Voltage spike	Category A
15	18	Audio Frequency Conducted Susceptibility	Category B
16	19	Induced Signal Susceptibility	Category ZCE, (E is required only for non-metallic enclosure)
17	20	Radio Frequency Susceptibility	Category W
18	21	Emission of Radio Frequency Energy	Category H
19	22	Lightning Induced Transient Susceptibility	B3K3L3
20	23	Lightning Direct Effects	Not Applicable
21	24	Icing	Category A
22	25	Electrostatic Discharge Requirements	Category A
23	26	Fire, Flammability	Category C (Flammability)

d) Mandatory information towards Maintainability Requirements

The following information is necessary to be provided by the Bidder. Without this information, the technical quote will be rejected.

• Shelf Life, Time Between Overhaul (TBO), Total Technical Life (TTL) should be commensurate with Industry standards and should be as high as possible. Values of shelf life, Time Between Overhaul (TBO), Total Technical Life (TTL) for the equipment shall be specified by Bidder based upon technology maturity level.

e) Product Support

a) Vendor shall provide on-site and off-site product support for technical inputs to certification and ground test, flight test activities.

b) Vendor should ensure all quoted Hydraulic System components/LRUs are fully certified and should be available for 30 years.

c) After Shelf-life expiry, product support to be provided by the OEM to make it as serviceable/OEM has to provide suitable procedures to make it serviceable.

f) Testing and Acceptance

The type testing shall be conducted as detailed in qualification test schedules/procedure. The acceptance tests for all components shall be as given in the relevant drawings. The qualification test schedule for Brake Manifold shall include examination of the product, acceptance test, leakage tests, verification test, proof pressure test, strength tests and other applicable tests as demanded as and when required till completion of aircraft type certification.

g) Disclaimer:

All data mentioned in this document is preliminary and subject to revision. All the appropriate clauses in the FAR 23, Amendment 64 based on FAR 23-63 regulations or latest version advisory circulars shall be complied.

4.2.3 List of Deliverables:

Sl. No.	Item Description	Quantity per Aircraft	Total Quantity
1.	Brake Manifold	1	5

4.2.4 List of Documentation:

Sl. No.	Item Description
1.	Supply of manuals for system level and LRU level
2.	All assembly and installation drawings shall be provided (Hard copies/CAD models)
3.	Brake manifold Performance data (Hydraulic/Electrical/Control data for all LRUs)
4.	LRU level test schedules to carry out pre installation checks of all mechanical, electrical and electronic components. Component Maintenance Manuals
5.	Components/LRUs Life document: Shelf life, TBO, Service Life etc.
6.	MTBF details for all LRUs
7.	System safety and Reliability assessment reports
8.	Mounting/Installation and interface drawings (Mechanical/Electrical)
9.	Component/LRU design specification
10.	Qualification test procedures (QTP)
11.	Qualification test report (QTR)
12.	Acceptance test procedure (ATP)
13.	Acceptance test reports (ATR)
14.	COC/FAA/EASA/DGCA/CEMILAC/DGAQA Approvals
15.	Declaration of Design and Performance (DDP)
16.	Operating instructions and first line maintenance instructions
17.	Wiring diagrams (If Applicable)
18.	Recommendations for ground support equipment
19.	Spares recommendation list
20.	Storage Procedure
21.	Electronic hardware Interface Control Document (ICD) to be provided and Datasheets if any
22.	Moment of Inertia values of LRU's (Ixx,Iyy,Izz,Ixy,Iyz,Ixz) to be provided.

4.2.5 Services

(i) Participation in the preliminary design review (PDR) and the Critical design review (CDR) to be held at CSIR-NAL Bangalore.
(ii) CSIR-NAL Team shall witness Qualification and System testing at Bidder's place.
(ii)If requested by CSIR-NAL; Bidder shall also provide engineering support during the integration of the Brake Manifold on to the Aircraft, including making an engineer available in India for a period not exceeding 5 working days (CSIR-NAL to provide office accommodation, local transport and communication facilities).

4.3 Scope of Supply and incidental works:

Scope of Supply includes the following:

(i) Supply of Brake Manifold
(ii) As per the LRU Specifications & Requirements along with the accessories as per clause No.4.2
(iii) Installation, Commissioning and Acceptance as per clause No.4.4.5
(iv) Training as per clause no.4.5
(v) On site comprehensive Warranty as per clause No.4.6.
(vi) Annual Maintenance Contract / Maintenance Support as per clause No.4.7
(vii) Delivery Schedule as per clause No.4.8.

CSIR-NAL Responsibilities:

1. Brake Manifold Specifications and Requirements.
2. Brake Manifold Architecture.
3. Review of Design and Performance report of Brake Manifold supplied by Bidder/Vendor.
4. Brake Manifold Installation design and Integration on aircraft.
5. Brake Manifold performance tests on ground and in flight.
6. Certification of Brake Manifold on aircraft in coordination with certifying regulatory authorities.

Bidders Responsibilities:

1. Provide list of documents mentioned in sec 4.2.4
2. Supply of Brake Manifold Performance tests and reports for the ground and flight cases.
3. Supply of Brake Manifold components/LRUs Specification, ATP, ATR, QTP, QTR, Envelope/ installation drawing, Performance data, DDP, Pre installation test schedule, Details of Shelf life, TBO, Service life etc. as specified in Para 4.2.4
4. Supply of Brake Manifold level and LRU level Electrical Wiring Diagrams with installation details (If Applicable).
5. Supply of Documents of Brake Manifold COC/FAA/EASA/CEMILAC/DGAQA/DGCA approvals of system/LRUs, System Safety and Reliability assessment
6. Review of Brake Manifold Installation design and Integration on aircraft.
7. Review of Brake Manifold LRU level performance test schedules and reports on ground and in flight.
8. Technical Support during Certification of Brake Manifold on aircraft in coordination with certification regulatory authorities.
9. Supply of Spares/ Sub systems/ LRUs of Brake Manifold and Support for Service on need basis.

4.4 Inspection & Tests

4.4.1 General

1. The Supplier shall at its own expense and at no cost to the Purchaser carry out all such tests and/or inspections of the Goods and Related Services as are specified here.

2. The inspections and tests may be conducted on the premises of the Supplier or its subcontractor(s), at the point of delivery and/or at the Goods final destination.

3. Whenever the Supplier is ready to carry out any such test and inspection, it shall give a reasonable advance notice, including the place and time, to the Purchaser. The Supplier shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.

4. Should any inspected or tested Goods fail to conform to the specifications, the Purchaser may reject the goods and the Supplier shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the Purchaser.

5. The Purchaser's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at final destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the Purchaser or its representative prior to the Goods shipment.

6. The Supplier shall provide the Purchaser with a report of the results of any such test and/or inspection.

7. With a view to ensure that claims on insurance companies, if any, are lodged in time, the bidders and /or the Indian agent, if any, shall be responsible for follow up with their principals for ascertaining the dispatch details and informing the same to the Purchaser and he shall also liaise with the Purchaser to ascertain the arrival of the consignment after customs clearance so that immediately thereafter in his presence the consignment could be opened and the insurance claim be lodged, if required, without any loss of time. Any delay on the part of the bidder/ Indian Agent would be viewed seriously and he shall be directly responsible for any loss sustained by the purchaser on the event of the delay.

8. Before the goods and equipment are taken over by the Purchaser, the Supplier shall supply operation and maintenance Manuals together with Drawings of the goods and equipment built. These shall be in such details as will enable the Purchase to operate, maintain, adjust and repair all parts of the works as stated in the specifications.

9. The Manuals and Drawings shall be in the ruling language (English) and in such form and numbers as stated in the Contract.

10. Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such Manuals and Drawing have been supplied to the Purchaser.

11. On successful completion of acceptability test, receipt of deliverables, etc. and after the Purchaser is satisfied with the working of the equipment, the acceptance certificate signed by the Supplier and the representative of the Purchaser will be issued. The date on which such

certificate is signed shall be deemed to be the date of successful commissioning of the equipment.

4.4.2 Manufacturer's Inspection Certificate

After the goods are manufactured and assembled, inspection and testing of the goods shall be carried out at the supplier's plant by the supplier, prior to shipment to check whether the goods are in conformity with the technical specifications. Manufacturer's test certificate with data sheet shall be issued to this effect and submitted along with the delivery documents. The purchaser reserves the options to be present at the supplier's premises during such inspection and testing.

4.4.3 Pre-Dispatch Inspection

(i)	The bidder will carry out pre-dispatch inspection at manufacturer's location and check for trouble free operation of the system. A separate report on the pre-dispatch inspection has to be provided with the supply of the system.
(ii)	Bidder to prove out all the specifications as outlined in the Chapter 4.
(iii)	Copy of the Inspection, Maintenance and Trouble Shooting manuals to be given to the representatives of CSIR-NAL. Explanation of the same to be done.

4.4.4 Third Party Inspection *(delete if not applicable) or elaborate.*

NA

4.4.5 Installation, Commissioning and Acceptance Test

The acceptance test will be conducted by the Purchaser, their consultant or other such person nominated by the Purchaser at its option after the equipment is installed at Purchaser's site in the presence of supplier's representatives. The acceptance will involve trouble free operation. There shall not be any additional charges for carrying out acceptance test. No malfunction, partial or complete failure of any part of the equipment is expected to occur. The Supplier shall maintain necessary log in respect of the result of the test to establish to the entire satisfaction of the Purchaser, the successful completion of the test specified.

On the event of the ordered item failing to pass the acceptance test, a period not exceeding two weeks will be given to rectify the defects and clear the acceptance test, failing which, the Purchaser reserve the right to get the equipment replaced by the Supplier at no extra cost to the Purchaser.

Successful conduct and conclusion of the acceptance test for the installed goods and equipment shall also be the responsibility and at the cost of the Supplier.

The acceptance tests at the final destination include the following:

a)	Visual Inspection
b)	Leakage Tests
c)	Room Temperature Functional/Performance Tests
d)	Bonding & Insulation Resistance Tests

4.5 Training

NA

4.6 Incidental Services

(i) On site Comprehensive Warranty:

- **3 Years** from Installation & Commissioning and date of acceptance
- In case the Equipment / System remains non-operational for more than **30 days** then warranty period will be extended for the equivalent period for which Equipment / System remained non-operational. Warranty extension in such case shall be done without prejudice to any other Term & condition of the contract

4.7 Annual Maintenance Contract (*delete if not applicable*) *or elaborate.*

Not Applicable

4.8 Delivery Schedule (including supply, installation, commissioning, training & acceptance)

Delivery of the Item		**Installation & Commissioning**		**Training At CSIR_NAL, if any**	**Acceptance of the item**
Days/ Weeks/Months	**Location**	**Days/ Weeks/Months from the date of receipt of equipment**	**Location**	**Days/ Weeks/Months from the date of Installation & Commissioning**	**Days/ Weeks/Months from the date of Installation, Commissioning & Training**
12 Months	CSIR-NAL, Bangalore	1 Month	CSIR-NAL, Bangalore	-	1 Month