TECHNOLOGY DEVELOPMENT FUND SCHEME

Project: Indigenisation of Pressure Gauge for Fixed Wing Aircraft

DTDF/06/13855/LN/PGFWA/X/R/M/0/
Annexure-C

Technology Development Fund (TDF) Scheme

Terms & Condition

1. Technology Development Fund (TDF) has been established to promote self-reliance in Defence Technology as a part of the 'Make in India' initiative. It is a programme of MoD (Ministry of Defence) executed by DRDO meeting the requirements of Tri-Services, Defence Production and DRDO.
2. The scheme encourages participation of public/private industries especially MSMEs so as to create an eco-system for enhancing cutting edge technology capability for defence application.
3. This project requirement is primarily for MSMEs/ Start-ups; and large industries will only be considered if no MSME/Startup is found suitable for the development of this technology.
4. MSMEs need to submit its UDHYOG AADHAR Number and Startups to be recognized through DPIIT (Department of promotion Industry & Internal Trade, erstwhile DIPP) certificate for consideration in the respective category of TDF Scheme.
5. The funding will be through provision of grants to public and private sector industry especially MSMEs that may work in collaboration with the academia or research institutions to carry out innovation, research and development.
6. Submission of EoI/DPR (Detailed Project Report) doesn't guarantee award of the project. EoI/DPR will be evaluated by the committee and accordingly suitable Technical Qualified industry after the approval of Competent Authority will be shortlisted for further consideration.
7. ***A technical interaction meeting may be conducted post issue of PDD with the companies. The companies will be intimated accordingly.***
8. Suitable technical information will be provided to the industries on submission of NDA (Non-Disclosure Agreement) during technical interaction meeting on 'need to know' basis.

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9. The company shall submit a compliance statement for all the eligibility requirements with necessary supporting documents for scrutiny.
10. The current guidelines and policies promulgated normally allow executing maximum of 3 concurrent projects through Development Agency (up to 2 projects as Lead DA).
11. The company will submit all information about their executed/ongoing/applied projects under TDF Scheme during the submission of EoI/DPR.
12. SOFT / Type Approval (CEMILAC Certification) is required for all airborne systems/subsystems. The details of the certification process can be seen in the guidelines published on the TDF website.
13. The transfer/sharing of IPR will be carried out under DRDO through a committee of DRDO officers. Filing of Patents and other IPR protection will be carried out by DRDO as per broad guidelines/policy of DRDO.

* **Any Industry providing false information will be liable for action as per existing MoD Guidelines**

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PART - A

1. Brief Description of the Project:

The TDF project 'Indigenisation of Pressure Gauge for Fixed Wing Aircraft' involves indigenous development of bourdon tube pressure gauge for Naval Aircraft.

Project Scope:

(a) Design, Development, manufacturing, testing, qualification, certification and supply of bourdon tube pressure gauge along with design calculations, drawings and valid factory test certificates.

(b) Each pressure gauge shall be supplied with suitable washer, dust cap and valid calibration certificate with packing.

(c) The entire responsibility for satisfactory design, manufacturing, testing, qualification and certification shall rest only with the firm; even though the firm's drawings and Inspection Plan are cleared by certification/approving agency.

2. Categorization [Sensitive/Non-Sensitive/Confidential/Non-Confidential]

Non-Sensitive / ~~Sensitive~~

3. Technology Parameter Requirement:

3.1. Technical specifications:

Sl. No	Parameter	Value
a)	Pressure Element	Bourdon tube
b)	Pressure Range	0 to 4,000 psi over 300° dial movement
c)	Overload pressure	6,000 psi
d)	Medium of Use	Dry Nitrogen gas
e)	Mounting connection	M12 x1 male connection
f)	Accuracy/Repeatability	± 2.5% FSD at 20° C
g)	Mounting Type	Vertical; Threaded offset connection
h)	Viewing Window Cover/Dial cover	Glass, without any liquid filling
i)	Endurance Cycles	10,000 cycles as per IS:3624
j)	Material of Construction	Shall be compatible with the marine and qualification environment
k)	Dial Markings	0 , 10, 20, 30 and 40 x 100 psi
l)	Operating Temperature	-40° C to +80° C
m)	Storage temperature	-40° C to +90° C
n)	Weight	≤ 170 g

4. Environmental Test Severity Levels for Qualification:

Sl. No	Parameter	Value
a)	Altitude	50,000 ft
b)	Acceleration	Structural: +13.5 g in each 6 directions for 1 min
c)	Random Vibration	0.04 g^2/Hz from 20 Hz to 1000 Hz and -6 dB/octave falling from 1000 Hz to 2000 Hz for 1 h in each axes

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d)	Shock Test	15 g half sine wave of 11 ms Total 18 shocks (3 shocks in each direction for 6 directions)
e)	Thermal Shock	-40°C to +80°C, 10 cycles as per MIL-STD-810G method 503.6 procedure I-B.
f)	High Temperature	+80°C for 1 h
g)	Low Temperature	0°C for 4 hours storage, -40°C for 1 hour operational
h)	Humidity	Humidity to vary between 30° C to 60° C and 85 to 95% RH
i)	Fungus (mould growth) direct Effect	Wet the entire surface of the test unit with Fungi spore (consisting of Aspergillus Niger, Aspergillus Terreus, Aurebasidium Pullulans, Paecilomyces Varioti, Penicillium Funiculosum, Penicillium Ochro-Chloron, Scopulariopsis Brevicaulis, Trichoderme Viride) in 10 minutes. Adjust the temperature to 30±1° C and humidity to 95% RH (or as specified in JSS55555) and allow an incubation period of 28 days. There shall not be any evidence of mould growth on any part
j)	Salt Fog	Expose the unit to salt fog of 5±1% concentration for a period of 24 hours followed by 24 hours of drying. This constitute one cycle. The drying shall be at controlled condition of 35±2°C and humidity of 90 to 95% RH. The composition of salt for preparation of solution shall be with sodium chloride containing not greater than 0.1% sodium iodide and not greater than 0.5% other impurities
k)	Rain Drip	Carry out the rain drip test for 15 minutes with volume flow rate between 250 to 280 l/m2/hr, through a dispenser kept approximately 1 meter above the test unit. Stabilise the test unit to room conditions and allow it to dry. Conduct Complete visual examination & Perform functional Test
l)	Dust Test	Expose the test units to blowing dust with concentrations of 10.6±7gm/m3 at velocity of 1.5 to 8.9 m/s and humidity of 30% RH for 6 hours at 23±1°C (or as per JSS55555)
m)	Liquid Contamination	Expose the test unit to test fluids with 7 days per fluid (total 28 days) at 65±3°C. The test fluids used shall be Fuel DERD 2494, Hydraulic fluid MIL - H - 5606E, Lubrication oil mixers to DERD 2497/MIL-L-7808 and Soap water

Note: all the qualification test shall be performed under pressurised condition

5. Inspection, Testing and Trials:

5.1 Quality Assurance Plan

a) Necessary Quality Assurance Plan (QAP) shall be made by the vendor, the Quality Assurance plan is to comply with relevant class specifications / standards. QAP shall be approved by IN/PMMG. Accordingly, changes advised by QAP approval authority shall be binding on the vendor.

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b) Prepared Quality Assurance Plan (QAP) shall include:

i. The schedule for inspection, test & trials should be drawn up in such a way that all inspections including component level inspection, trials of subassemblies, etc., should be, as far as feasible performed at the corresponding stage of manufacture. Detailed measurements should be carried out at the appropriate stage of manufacture.

ii. Vendor to ensure implementation of approved QAP with evidence / records.

iii. Approved QAP to be submitted to IN/PMMG for reference/records.

5.2 Test / Inspections:

a) The performance requirement of the pressure gauge to be demonstrated during Factory Acceptance Test (FAT) at manufacturer's place in presence of inspection authority. Vendor to ensure availability of calibrated test equipments during the performance evaluation.

b) Amendments if any to the FAT, QAP, inspection and control plan proposed shall be agreed after discussion between IN/PMMG and vendor prior to implementation.

c) Firm should send 01 weeks' notice to IHQ / PMMG before test/trials of equipment to witness factory acceptance test.

5.3 Test Reports:

a) Results of tests duly approved are to be provided to IN/PMMG by Firm. Four copies of the test results are to be forwarded to IN/PMMG.

b) One copy of tests results is to be submitted to inspection authority during tests.

c) The clearance for dispatch of the pressure gauges would be accorded by IHQ/ DME on successful completion of FATs and the liquidations of all FATs observations, if any.

5.4. Qualification Test requirement.

Random samples will be selected from the first lot of 25 Nos. Of pressure gauges produced initially for subjecting to qualification tests. The number of samples will be decided by the inspection agency with the approval of IN/PMMG. Once the qualification tests are completed, vendor shall obtain Flight Clearance Note (FCN) / Type approval from CEMILAC for aircraft integration and flight evaluation. The supplier should also furnish data/information about the methods/measurements carried out in evaluating the performance of the equipment during the trials.

Note - Offer with Non-Type Tested equipment may be liable for rejection.

5.5 General Instructions for Qualification and Production Tests

a) The aim of the qualification and production test is to confirm to the performance characteristics of each equipment

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b) OEM is to prepare proposals for the programme and conduct of the qualification and production tests. These qualification and production test programme proposals are to be submitted for approval of IN/PMMG. Approved copy of qualification and production test programme should be forwarded to IN/ IHQ /PMMG and are to include the following information.

i. Date of commencement and completion of the qualification and production test.

ii. Delivery date to IN.

iii. Place of test

iv. Name and telephone number of person responsible for test

v. Itemized list of test and duration of each.

vi. Specified duties.

vii. Estimates or performance.

viii. Details of holding down arrangements.

ix. Details of each itemized test including measurements to be taken and recorded.

x. A sketch of the test rig showing the points at which measurements are to be taken.

xi. Details of measuring equipment and standard of accuracy.

xii. Methods of ensuring that fluids used conform to specifications are to, together with details of oils and grease, which shall be used.

5.6 Examination on Completion of Test

After completion of the qualification and production test, each unit to be opened up to the extent required by the IN/PMMG and as per OEM recommendation. After examinations, the same is to be re-assembled and closed to meet customer satisfaction.

5.7 Results of Production Tests

a) Results of tests in tabular and graphical form (duly approved by Class) are to be provided to IN/PMMG by Firm. Four copies of the test results are to be forwarded to IN/PMMG, one for retention and three for ship record.

b) One copy of tests results is to be supplied to IN/PMMG each for acceptance during tests.

5.8 FAT Approval

The OEM shall give the procedure and format for FAT to be prepared for on-board installation inspection and trials. These documents have to be approved by IHQ. OEM shall send one copy of the FAT documents to IN/PMMG for comments. Post

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incorporation of the comments, final document is to be submitted by OEM to IN/ IHQ/PMMG for approval. The document must include all alignment/ preservation/ de-preservation procedure. The FATs schedule has to be sent to IHQ at least 01 weeks prior to the conduct of the FATs.

6. Documentation:

6.1 Basic Data:

The following basic details are to be furnished by the firm as a part of binding Data:

a) Dimensions and End Connections in line with installation drawing
   i. Overall dimensions
   ii. Connection Details
   iii. Mounting details

b) Material Specification: Traceability of all the materials used for fabrication of pressure gauge shall be provided.

c) Material Properties
   i. Tensile Strength
   ii. Yield Strength (Min.) at room temperature (in N/sq. mm)
   iii. Yield Strength (Min.) at 70 degrees Centigrade (in N/sq. mm)
   iv. Percentage Elongation (Minimum)

d) Chemical Composition

6.2. Standards/Calibration reports:

Certificates should support standards where standard components are used. All gauges & Instruments shall be calibrated & shall accompany with a calibration certificate valid for one year post installation.

6.3. Drawings for Approval:

The drawings should clearly indicate the following:

a) Governing specification for design, manufacture & testing
b) Range of the pressure gauge
c) Proof pressure
d) Calibration points
e) Dimension and tolerances for length, diameter, thickness and other critical dimension
f) Complete end connection details and threading details
g) Details of washers / seals if any

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h) Surface standard and painting details for external surface.

i) Estimated weight

j) Any other relevant information like performance limitation on shock, fire, fatigue /cyclic, expected life span.

k) Part identification list

6.4 Approval of Drawing:

a) All drawings/control philosophy/scheme required for approval will be responsibility of OEM. OEM shall submit binding data/drawings to IN/PMMG.

b) Equipment/ items along with accessories etc., to be manufactured strictly as per approved drawing.

6.5 First submission of data.

Following data are to be provided by technology developer

a) Technical description of the equipment.

b) GA drawing of the equipment & major sub-assemblies along with foot print

7. Feasibility Study Details

Feasibility Study has been carried out for development of indigenous pressure gauge for Aircraft through multiple firms. The studies indicate that development of indigenous pressure gauge is feasible with indigenous content as high as 70 %.

8. Phases of Implementation/ Scope of Development with Milestones

8.1 Milestone 1

a) PDR of baseline design concepts.

b) Development of detailed design based as per platform requirement and PDR outputs. The design shall be submitted for preliminary review by DRDO.

c) Presentation of design to PMMG.

d) Vetting of the design by PPMG.

8.2 Milestone 2

a) Design validation through prototype testing for performance.

b) Conduct of review and approval for prototype manufacturing.

c) Preparation of Design Documents, drawings, QAP, FAT protocols and their approvals.

8.3 Milestone 3

a) All Modifications/improvement suggested by IN/PMMG after FATs to be incorporated by the firm into engineering units.

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b) Verification/concurrence by IN/PMMG for implementation of modifications as suggested by IN/PMMG

8.4 Milestone 4

a) Removal of pressure gauge and retro fitment of engineering unit with existing platform and commissioning.

b) Preparation of technical description, fitment drawing, O&M manuals and other documents.

8.5 Milestone 5

a) Type testing of pressure gauges

b) Supply of 06 Nos. of pressure gauge

c) Documentation including but not limited to Project Design Reports, Measurements & QT reports, Project Success Report, ToT Document, Operation Manual, Maintenance Manual, Calibration Certificate and IPR Documents.

10. Exit Criteria/ Risk Management

a) The progress of the project work will be technically assessed by PMMG/DRDO based upon mutually agreed milestones within the given time frame.

b) If the Developing Agency (DA) failed to demonstrate technically as per the mutually agreed milestones and/or if there are undue time and cost overruns during the development phase, the DA will be asked to submit Project Failure Report (PFR).

c) The PFR will be reviewed by the committee members of TDF and the project will be closed after their review and approval. Thereafter the project accounts will be settled.

11. Time Frames for Execution of the Project:

The maximum time frame for execution of complete projects shall not be more than 24 months from date of initiation of project as per TDF SoP / Policy and Guidelines

12. Life Cycle Management:

a) **Product Support**: The supplier is to confirm product/ service support for next 10 years for the equipment/ spares/systems offered by them. In case the equipment is likely to be obsolescent after the said mandatory period, the supplier shall notify the IN with two years prior notice. In the event of any obsolescence during the product support period in respect of any components, mutual consultation between IN and OEM shall be undertaken at an acceptable solution including additional cost, if any.

b) **Spares:** The Commissioning spares and one set of On-board spares if any along with tools, test equipment and one set of Base & Depot spare (to cater for requirement up to five years) are to be supplied by OEM as part of initial contract.

c) **Installation & Commissioning Spares:** Firm shall bring adequate commissioning spare for satisfactory commissioning of equipment / system. Unused commissioning spares

may be taken back by the firm. All spares/ instruments etc. required for Trials / Commissioning of equipment shall be arranged by the firm.

13. Compliance Matrix:

A Compliance Matrix wrt specification and qualification test requirements shall be specifically indicated by the firms submitting Project report/offer. Deviations from specifications be particularly highlighted: Technical Specification Para Reference in PDD Para Reference in offer/ Project Report Compliance Remarks if any

Note: Notwithstanding any specifications mentioned in this PDD, any requirements as per statutory regulations, safe/ good Engineering practices need to be adhered to. Any clarifications wrt specifications in PDD are to be clarified prior submission of final report/ offer.

14.0 Applicable Standards:

a) EN 837-1: Bourdon tube pressure gauges – Dimensions, metrology, requirements and testing
b) IS 3624: Specification for pressure and vaccum gauges
c) JSS 55555: Environmental Test Methods for Electronic and Electrical Equipments
d) MIL-STD-810G: Environmental Engineering Considerations and Laboratory Tests

15.0 Essential Vendor Qualification Criteria:

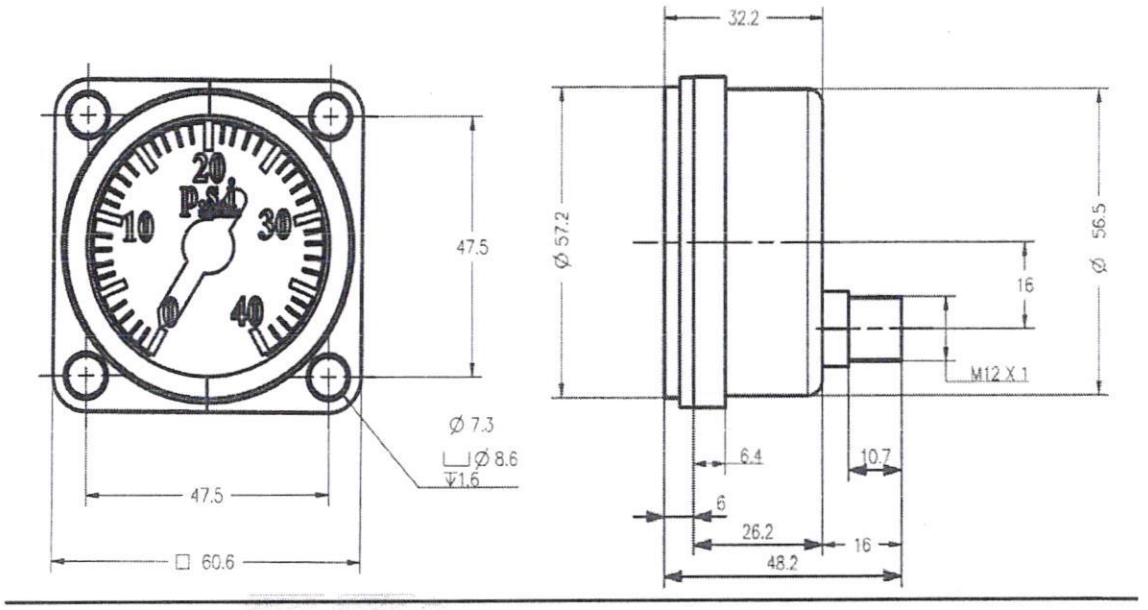
The broad criteria for qualifications of bidders should be in the following terms:

a) Technical Capabilities: bidder shall have experience of design, development and supply of high pressure (≥150 bar) bourdon tube pressure gauges.
b) Infrastructure: bidder shall have in-house facilities for manufacture and testing of bourdon tubes and its assembly.

16.0 Final Deliverables

a) 06 Nos. of pressure gauge properly packed with necessary spares & consumables if any.
b) Documentation: project design reports including Critical Design Review and other design documents, measurements & QT reports, FATs Reports, Operational & Maintenance manual, calibration certificates, material traceability reports, simulation reports, ToT documents, IPR documents, any other relevant reports and drawings as applicable.

17.0 The indicative drawing of Pressure Gauge



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