



Department of Applied Mechanics
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Ref. No: APM/2019/002/CLR

Split Hopkinson Pressure Bar (SHPB)

DATE: 24.05.2019

DUE DATE: 13.06.2019

- 1) Quotations are invited in duplicate for the various items shown in Enclosed list (Annexure - I).
- 2) Quotations are invited as TWO-BID system, i.e., **technical bid and financial bid**.
- 3) The Quotations duly sealed and super scribed on the envelope with the reference No. and due date, should be addressed to the undersigned so as to reach him on or before the due date stipulated above.
- 4) The Quotations should be valid for sixty days from the due date and the period of delivery required, warranty terms etc. should also be clearly indicated. A minimum of two year warranty required.
- 5) Brochure detailing technical specifications and performance, list of industrial and educational establishments where the items enquired have been supplied must be provided.
- 6) Compliancy certificate is to be provided indicating conformity to the technical specifications.
- 7) If the item is under DGS&D Rate contract No. and the price must be mentioned. It may also please be indicated whether the supply can be made direct to us at the Rate contract price (Please note that we are not Direct Demanding Officers). If so please send copy of the RC.
- 8) Relevant literature pertaining to the items quoted with full specifications (and drawing, if any) should be sent along with the Quotations, wherever applicable. Samples / machine/ equipment if called for should be submitted / demonstrated at free of charges, and collected back at the supplier's expenses.
- 9) Packing and delivery charges must be clearly indicated.
- 10) The rate of sales / General Taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for Sales / General Taxes will be admitted at any stage and on any ground whatsoever. The taxes leviable should take into consideration that we are entitled to have concessional Sales Tax applicable to nongovernment Educational Institutions run with no profit motive for which a concession. Sales Tax Certificate will be issued at the time of final settlement of the bill.
- 11) Goods should be supplied carriage paid and insured.
- 12) Goods shall not be supplied without an official supply order.
- 13) Payment: Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.
- 14) In case of LC, 90% of the payment will be made after completion of the supply. The balance 10% of the payment will be made after satisfactory installation of the software.

- 15) IIT Madras is exempt from payment of Excise Duty and is eligible for concessional rate of custom duty. Necessary certificate will be issued on demand. IIT Madras will make necessary arrangements for the clearance of imported goods at the Airport/Seaport. Hence the price should not include the above
- 16) Acceptance and Rejection: - I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.

Yours faithfully
C. Lakshman Rao,
Department of Applied Mechanics.

Technical Specifications for Split Hopkinson Pressure Bar (SHPB) System Mechanical unit

The Split Hopkinson Pressure Bar (SHPB) System is used for testing different materials at high strain rates in compression. Original equipment manufacturer (OEM) is required to supply one Split Hopkinson Pressure Bar system to IIT Madras which can be used to test materials in compression mode and it should meet the following technical requirements.

- 1) The Split Hopkinson Pressure Bar (SHPB) System should be capable of conducting compressive testing at strain rates ranging from 300 s^{-1} or less to 8000 s^{-1} or more at room temperature. The minimum & maximum values attained by SHPB system should be indicated by the OEM in technical bids.
- 2) The Original Equipment Manufacturer (OEM) has to fabricate the SHPB system with High strength material so that all Al alloys, Cu- alloys, Mg alloys, Ti base alloys, Ni-base & Co-based super alloys (typical yield strengths of these materials would be varying from 600 MPa to 1400 MPa) can be tested in the strain rate ranges mentioned above in compression mode.
- 3) The OEM has to design the Split Hopkinson Pressure Bar (SHPB) system and its accessories so as to facilitate high temperature testing (in compression: 300 s^{-1} or less to 8000 s^{-1} or more) ranging from room temperature to $80 \text{ }^\circ\text{C}$. Maximum temperature comfortably attainable by the SHPB system with no deleterious effect on the results as well as on the instrument should be indicated by the OEM in technical bids.
- 4) The striker bar accelerator assembly of SHPB system should contain a gas reservoir gun which can operate compulsory by compressed air to impart velocities to the striker bar ranging from 5 m/s to 50 m/s, through a barrel (launch tube).
- 5) All the gas connecting tubes, control knobs and pressure gauges, required for controlled filling (through non-returnable valve) of gas gun reservoir with propelling gases from gas cylinders or air compressor and also for measuring the gas pressure inside the gas gun reservoir should be supplied by the OEM. The gas reservoir pressure indicator should be of LED type indicator with display up to two decimal points.
- 6) The gas reservoir should be designed for controlled filling as per the user requirement through a non-returnable valve as well as a release valve for controlled releasing of the gas reservoir gases.
- 7) Vents should be provided at the down end of the barrel, to release the propelling gases from behind the striker, to achieve constant velocities of striker bar just before the impact of striker bar with incident bar.
- 8) OEM is required to design the barrel near & around the vent section in such a way it suppresses rapid release of the propelling gases in to the working atmosphere.

- 9) The SHPB system should be capable of accommodating different lengths of striker bars and also striker bars of different materials.
- 10) The striker bar accelerator assembly of SHPB system should be mounted separately from the mount assembly of the test bars so as to prevent vibrations generated during the acceleration of the striker bar from adversely affecting the experiment.
- 11) Necessary fixtures for incident bar and transmitter bar should be supplied for enabling compression mode of testing and also to endure high strain rate , high temperature testing.
- 12) Necessary bar mountings should be provided for aligning all the bars to assure proper contact at the specimen interface. This bar mountings/ supports should be designed in such a way that it ensures low-friction, free movement of the bars only in the axial direction.
- 13) Necessary provisions should be made in the bar mountings so as to accommodate bars of different diameters and lengths.
- 14) Momentum trap arrangement should be incorporated in the SHPB system so as to avoid multiple loading of the test specimen and also to restrict the loading of the test specimen to a single loading cycle. All the necessary fixtures should be supplied for enabling the same.
- 15) OEM has to assemble mountings, supports, launcher tube & compressor..etc with striker, incident, transmitted bars at the installation site IIT Madras.
- 16) Pre-inspection and training at IITM for Students on assembling of bars in bar supports and in launcher tube at room temperature in compression. Sample preparation techniques, calibration procedures involved at the desired strain rates should also be covered in the pre inspection training.

ANNEXURE – I

Deliverables for Split Hopkinson Pressure Bar (SHPB) mechanical unit

S. No	Description	Technical Specification	Quantity						
1	SHPB Launcher	Velocity range : 5-50 m/s Gas reservoir gun: Operated by air Striker bar of diameter 12.5 mm has to fit inside the SHPB Launcher	01 01						
	1 a) Gas gun reservoir	The gas reservoir should be designed for controlled filling as per the user requirement through a non-returnable valve as well as a release valve for controlled releasing of the gas reservoir gases.	01						
	1 b) Gas connecting tubes, control knobs and pressure gauges, pressure indicators	<table style="border: none; width: 100%;"> <tr> <td style="border: none; vertical-align: middle;"> gas connecting tubes control knobs pressure gauges </td> <td style="border: none; vertical-align: middle; font-size: 2em;">}</td> <td style="border: none; vertical-align: middle; text-align: center;"> Controlled filling (through non-returnable valve) </td> </tr> <tr> <td colspan="3" style="border: none;"> Pressure indicator : LED type </td> </tr> </table>	gas connecting tubes control knobs pressure gauges	}	Controlled filling (through non-returnable valve)	Pressure indicator : LED type			As required
gas connecting tubes control knobs pressure gauges	}	Controlled filling (through non-returnable valve)							
Pressure indicator : LED type									
	1 c) Gun barrel	Vents should be provided at the down end of the barrel, to release the propelling gases from behind the striker.	As required						
2	Compressor	Type : Air Max. pressure : 15 bar Operated pressure : 12 bar	01						
3	Necessary fixtures enabling compression and tensile mode of testing	Necessary fixtures for incident bar and transmitter bar should be supplied for enabling compression and tensile mode of testing and also to endure high strain rate, high temperature testing.	As Required						
4	Test bar mounts with low-friction bushings	Low-friction, free movement of the bars in the axial direction. Necessary provisions should be made in the bar mountings so as to accommodate bars of different diameters and lengths.	As Required						
5	Beam assembly and legs for mounting	Necessary support systems should be provided to the entire SHPB bar assembly via beam assembly and legs for mounting on the test floor. Necessary precautions should be taken to minimize the passage of vibration to the test floor.	As Required						
6	Momentum trap arrangement	Momentum trap arrangement should be incorporated in the SHPB system so as to avoid multiple loading of the test specimen and also to restrict the loading of the test specimen to a single loading cycle. All the necessary fixtures should be supplied for enabling the same	01						