

**CORRIGENDUM – 1**

**Revision of Annexures**

**EOI No. ICAT/EOI/NBD/06  
Manesar, 23<sup>rd</sup> May, 2023**

This notification is with reference to the EOI No. ICAT/EOI/NBD/06 published by International Centre for Automotive Technology (ICAT) on 16<sup>th</sup> May, 2023 for the following works.

Description of work	Deployment of alternate fuel technologies on Marine engine for fishing vessels from reputed technology providers/kit manufacturers
Revision of Annexures	Both the Annexures (i.e. Annexure-I and Annexure-II) have been replaced. These revised Annexures Supersedes the Annexures enclosed in the initial EOI.

This corrigendum shall be treated as an integral part of the EOI as mentioned above.

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### Annexure - I A (Kit Approval Requirements for individual components)

Sr. No.	LPG Kit Component	Approving/ Certifying/ Verifying Authority	Clause of AIS 026/027/ Other Rules, Standards, etc.
1a	Cylinder for four-wheelers and above	Department of Explosives, Nagpur to approve/endorse in case of foreign make	ECE-R-67-01 or IS:14899-2000 or as approved under Gas Cylinder Rules, 1981
1b	Cylinder for two-wheelers and three wheelers	Department of Explosives, Nagpur to approve/endorse in case of foreign make	ECE-R-67-01 or IS:14899-2000 Or as approved under Gas Cylinder Rules, 1981
2	Cylinder Valves/Multi-Function Valve	Department of Explosives, Nagpur to approve/endorse in case of foreign make	ECE- R-67-01 or IS: 15100-2001 or as approved under Gas Cylinder Rules, 1981]
3	Regulator/Vaporizer*	Testing or verification of certificate with test report by Test Agency as per United Nations, Economic Commission for Europe Regulation No. 67 Rev. 1	United Nations, Economic Commission for Europe Regulation No. 67 Rev. 1 Note: Regulator/vaporizer is to be tested, as per Economic Commission for Europe Regulation No. 67 (Rev.1), including endurance test for 6,000 number of cycles
4	Gas-Air Mixer*	Testing/verification of certificate with test report by Test Agency as per United Nations, Economic Commission for Europe Regulation No. 67 Rev. 1	United Nations, Economic Commission for Europe Regulation No. 67 Rev. 1
5	Petrol and Gas Solenoid Valves*	Testing/verification of certificate with test report by Test Agency as per United Nations Economic Commission for Europe Regulation No. 67 Rev. 1	United Nations, Economic Commission for Europe Regulation No. 67 Rev. 1 or equivalent standard. Note: Petrol solenoid valve is to be tested, as per Economic Commission for Europe Regulation No. 67 (Rev. 1), for endurance only at a pressure 1.5 times the working pressure for

			6,000 numbers of cycles.
6	<p>Inspection, Testing and Commissioning Certificate</p> <p>(a) Leak testing</p> <p>(b) Excess flow valve test*</p> <p>(c) Automatic fill limiter*</p> <p>(d) Compartment/sub Compartment</p>	To be tested by Test Agency	Clause 14 of AIS 026/ AIS 027
7	Filling Connection	Installation on vehicle to be checked by test Agency	As per Appendix A, Clause (d) of AIS 026/AIS 027
8	Ventilation	Test Agency to verify	Clause 8 (E) of AIS 026/AIS 027
9	Testing of Conduit*	Testing/Verification of Certificate with Test Report by Test Agency as per equivalent standard	Clause 8 (F) (iii) of AIS 026/AIS 027
10a	<p>LPG fuel line exceeding 4.5 kg/cm<sup>2</sup>*</p> <ul style="list-style-type: none"> <li>● Pressure testing</li> <li>● Size of tube as per engine capacity</li> <li>● Fitment on vehicle</li> </ul>	<ul style="list-style-type: none"> <li>● Testing/Verification of Certificate with Test Report by Test Agency as per equivalent standard</li> <li>● Manufacturer's declaration to be verified by Test Agency</li> <li>● Verification by Test Agency as per Safety Code of Practice</li> </ul>	<p>Clause 9 of AIS 026/ AIS 027</p> <p>Clause 9 (i) of AIS 026/AIS 027</p> <p>Clause 9 (ii) of AIS 026/AIS 027</p> <p>Clause 9 (v) of AIS 026/AIS 027</p>

10b	(b) Flexible Hose/fuel line not exceeding* 4.5kg/cm2 ●Material ●Fitment on vehicle ● Pressure	<ul style="list-style-type: none"> <li>● Testing/Verification of Certificate with Test Report by Test Agency as per equivalent standard</li> <li>● Verification by Test Agency as per Safety Code of Practice</li> <li>● Testing/Verification of Certificate with Test Report by Test Agency as per equivalent standard</li> </ul>	<p>Clauses 10 of AIS 026/AIS 027  Clause 9 (ii)a of AIS 026/AIS 027  Clause 10B, 9 (v) of AIS 026/AIS 027  Clause 10(A)(i) of AIS 026/AIS 027</p>
10c	Joints and connections to withstand Pressure without any leakage	Verification by Test Agency	Clause 9(iv) and 10(A) of AIS 026/AIS 027
11	Compartment / Sub-compartment*	Test to be carried out by Test Agency as per Safety Code Practice	Clause 8D of AIS 026/AIS 027
12	Safety check for installation of LPG system	Safety checks to be carried out by Test Agency as per Safety Code of Practice	Relevant clause of AIS 026/AIS 027
Note:-	Only the latest version of all the standards, as mentioned, shall be referred for compliance.		

## Annexure - I B (Kit Approval Requirements for individual components)

Sr. No.	CNG/BIO-CNG/LPG Kit Component	Certifying /Verifying Authority	Clause of AIS 028/Other Rules, Standards, etc.
1	CNG/BIO-CNG/LNG Cylinder*	PESO, Nagpur to certify or endorse in case of foreign make	[Gas Cylinder Rules, 2016] or International standards as endorsed by PESO
1.1	Fitment of cylinder on vehicle	Test agency to verify as per AIS 028	Clause no. 2.3,2.5 and 2.6 of AIS 028
2	CNG/LNG (Shut off valve) Cylinder valves*	PESO, Nagpur to certify or endorse in case of foreign make	IS: 3224 (for CNG valves) or [Gas Cylinder Rules, 2016] or International standards as endorsed by PESO
3	Regulator (CNG)/Regulator and vaporizer/heat exchanger(LNG)*	Testing of the component as per IS:15713 -2006 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory. LNG regulator and Vaporizer/heat exchanger shall meet requirements of ECE R110 or equivalent standard	IS:15713-2006 or ISO-15500 ECE R110 or equivalent standard
4	Gas-Air Mixer*	Testing of the component as per IS: 15714-2006 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15714-2006 or ISO-15500
5	Gas injector	Testing of the component as per ISO 15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	ISO 15500
6	Petrol Solenoid Valve*	Testing of the component as per IS: 15717 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15717

6.1	Gas Solenoid Valve*	Testing of the component as per IS: 15712 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory. Automatic valve of LNG System shall meet requirements of ECE R110 or equivalent standard	IS: 15712-2006 or ISO -15500 Automatic Valve for LNG System: ECE R110 or equivalent standard
7	Filling Connection (NZS & NGV-1 type) for CNG/ LNG receptacle	Installation on vehicle to be checked by test agency as per AIS 028	Clauses 2.2.2,2.2.3,2.2.4, 2.2.5 and 2.2.6 of AIS 028
8	Ventilation	Test agency to verify	Clauses 2.4.2 of AIS 028
9	Testing of Conduit*	Testing of the component or verification of certificate or test report as per IS: 15715 by test agency.	IS: 15715
10	CNG/BIO-CNG/LNG fuel line		
10.1	High pressure – exceeding 100kPa*	100 Kpa*	
10.1.1	Exceeding 2.15MPa — Rigid pipe — Flexible hose	Testing of the component or verification of certificate or test report as per IS: 15716 by test agency. LNG rigid pipeline shall meet requirements of ECE R110 or equivalent standard Testing of the component or verification of certificate or test report as per IS 15718 by test agency. LNG pipeline shall meet requirements of ECE R110 or equivalent standard	IS 15716 ECE R110 or equivalent standard IS 15718 ECE R110 or equivalent standard
10.1.2	Pressure upto 2.15Mpa	Testing of the component or verification of certificate or test report as per IS: 15722 by test agency. LNG pipeline shall meet requirements of ECE R110 or equivalent standard	IS: 15722 with amendments ECE R110 or equivalent standard
10.2	Joints and connections*	Testing by test agency. LNG joints & connection shall meet requirements of ECE R110 or equivalent standard	Clause 3.1.4.1, 3.2.1 (b) of AIS 028 ECE R110 or equivalent standard
11	Compartment or sub-compartment*	Testing of the component or verification of certificate or test report as per IS: 15720 by test agency.	IS: 15720

12	Specific LNG components	(a) Following specific components, as applicable shall meet requirements of ECE R110 or other international standards (b) Electronics Control Unit, Pressure and/or temperature sensor (if not part of LNG cylinder)	ECE R 110 or equivalent standard
13	Safety check for installation of CNG/BIO-CNG/LNG system	Safety check to be carried out by test agency as per AIS 028	Relevant clauses of AIS 028
*	Certificate issued by accredited test agency by the By the country of origin, Or a report. Issued by. Internationally accredited testing laboratory may also be accepted.		
Note 1:	Only the standards, as amended from time to time, as mentioned above, shall be referred for compliance.		
Note 2:	LNG system components downstream of vaporizer or heat exchanger shall be considered as CNG components.		
Note 3:	Test agency to conduct applicable CMVR test as applicable with commercial available LNG fuel.		
Reference:- ANNEXURE IX [See Para E of rule 115-B], SAFETY CHECKS FOR USE OF CNG/ BIO-CNG/LNG FUELS IN INTERNAL COMBUSTION ENGINED VEHICLES (AS PER AIS 028) AND INDIAN GAS CYLINDER RULES, 2004			

## Annexure – II

### Baseline Data Sharing:

ICAT shall provide the baseline data for the test vehicles, which will be used as a reference to assess the performance of the retrofitment kits. The participating companies are expected to utilize the baseline data for designing the retrofitment kits.

### Retrofitment, installation instrumentation, and cost of tests:

The participating companies are required to bear the cost of retrofitment, installation instrumentation, and tests to be performed after the kit installation. Proper installation and instrumentation of the retrofitment kits in the vehicles should be ensured as per the requirements of the EOI document.

### Test Procedure

The engine is first coupled with the dynamometer, which consists of a base and a rotating torque flange. The engine's output shaft is connected to the torque flange via a driveshaft, allowing the engine to turn the torque flange. The torque flange is equipped with sensors that measure the engine's torque and speed output.

Once the engine is mounted, it is started up and allowed to warm up to its normal operating temperature. The dynamometer is able to simulate different load conditions by applying a controlled load to the engine via the torque flange.

As per ISO 8178, Test Cycles E4 and E1 are to be used for testing of Marine Application Engines.

A small description of the test cycle is given below:

#### Applicable Cycle (for Spark Ignition Engines): E4

Mode Number	1	2	3	4	5
Speed, <sup>a</sup> %	100	80	60	40	idle
Torque, %	100	71.6	46.5	25.3	0
Weighing Factor	0.06	0.14	0.15	0.25	0.40

\*Note: <sup>a</sup> is the declared Rated Speed

#### Applicable Cycle (for Diesel Engines ): E1

Mode Number	1	2	3	4	5
Speed, %	Rated Speed		Intermediate Speed		idle
Torque, %	100	75	75	50	0
Weighing Factor	0.08	0.11	0.19	0.32	0.3