

**Reasoned Document for Draft Specification of Oil Lubricated Compressor having Capacity 1745 lpm RDSO/2018/EL/SPEC/0137 Rev '1' the comments received from M/s FTRTIL, M/s AIMPL & Rly/SCR**

CL no.	Description in Specification	Comments from Manufacturers & Railways		RDSO Remarks
		Firms	Comments	
1.0	<b>Scope</b>			
1.2	The inlet air for the compressor shall be filtered air at ambient temperature available in the machine room of the electric locomotives for onboard arrangement and shall be unfiltered in under slung mounting arrangement for electric locomotives.	M/s ELGI	No Comments	No Comments
		M/s AIML	Accepted	Noted
		M/s KBIL	No Comments	No Comments
		M/s FTRTIL	No Comments	No Comments
		RLY/LGD	<p><b>Existing wording</b></p> <p>The inlet air for the compressor shall be unfiltered in under slung mounting arrangement for existing locomotives.</p> <p><b>To be added</b></p> <p>The existing single stage filter (double layered) is not able to filter the fine dust which in entering into the system and causing heavy carbonization in disc valves of LP &amp; HP cylinders . Hence in place of existing single stage filter , two stage filter is to be provided for efficient filtering of dust at inlet.</p>	<p>The compressor manufactures are using 2 stage filters (Inner and outer side). As per discussion with manufacturers.</p> <p><i>Firm's/Rlys are requested to submit comments on SCR's Comments.</i></p>
		M/s AIML	Accepted	Noted
		M/s KBIL	No Comments	No Comments
		M/s FTRTIL	No Comments	No Comments

		RLY/LGD	No comments	Noted
2.0	<b>Climate and environment conditions</b>			
	Maximum atmospheric temperature : under sun: 70 : In shed : 50 °C	M/s ELGI	No comments	
	Humidity : 100% saturation during. rainy season	M/s AIML	Accepted	Noted
	Locomotive and equipment will be designed to work in coastal areas (humid and salt laden atmosphere) and in desert areas (externally dust atmosphere):	M/s KBIL	No comments	
		RLY/SCR	<p>The compressors are under slung and are prone to foreign material hit and vibrations. Therefore the following to be strengthened to withstand foreign material hit/vibrations.</p> <ol style="list-style-type: none"> <li>1. Intercooler / after cooler and safety valves / drain plugs are to be protected properly to avoid foreign material hit. The thickness of covers protecting cooler pipes should be capable of avoiding damage to the pipes.</li> <li>2. CP cooling fan should be properly covered to avoid foreign material hit to the fan blade.</li> </ol> <p><b>The grade of material used for fan blades to be revised since aluminum blades are breaking frequently during CRO/external hit.</b></p> <p>M/S ELGI inter cooler plates and protection covers thickness is less and becoming defective whenever CRO take place. Also</p>	<p>The fan guard has been modified by M/s ELGI which are running successfully in the field.</p> <p>Firm's/Rlys to provide comments on SCR's Comments.</p>

			M/S ELGI CP fans are exposed to foreign material hit and breaking online frequently. <b>Modified Fan Guard provided, should be as per FTIL design for FTIL make compressors and for ELGI compressor should be as per LGD drawing no C/ELS/LGD/AUX/3/44.</b>	
		M/s FTRTIL	No comments	
4	<b>Technical Data:</b>			
4.2	<b>Design Features</b>	RLY/SCR	Easy accessibility of LP / HP disc valve heads should be made to enable disc valve plates cleaning during IC schedule in position without taking CP to shop floor.	It will be major change in design. Firm's to provide comments.
4.2.2	Inter Cooling and after Cooling of air shall be provided with the compressor so as to limit the final delivery air temperature which shall not be more <b>than 23 °C</b> above ambient when working at a pressure of 10.2 kg/cm <sup>2</sup> . (To be measured during Mechanical tests as per clause 7.3.1)	M/s ELGI	No comments received	
		M/s AIML	Accepted	Noted
		M/s KBIL	No comments received	
		M/s FTRTIL	Inter Cooling and after Cooling of air shall be provided with the compressor so as to limit the final delivery air temperature which shall not be more than 20°C <del>23°C</del> above ambient when working at a pressure of 10.2 kg/cm <sup>2</sup> . (To be measured during Mechanical tests as per clause 7.3.1) <b>FT strongly suggest to keep Compressor outlet temperature should be Ambient +20°C</b>	The ambient temperature were taken after the discussion with manufacturers during making specifications. So its not relevant .
		RLY/SCR	<b>4.2.3</b>	Agreed, the Flexible

			<p><b>NEWLY</b> Flexible hose pipe for use on delivery side should be of Reinforced Rubber Hose to SAE 100 RI/R2 standard as per RDSO L. No. EL/3.2.15/3-Phase dated 01.04.2019 and shall be capable of withstanding the delivery of hot air temperature. OEM of compressor should supply delivery hose pipes with necessary end fittings (Flange/nipples/elbows) along with the compressor.</p> <p>4.2.4 a) For M/s FTIL make compressor type 2A320D and For M/s ELGI make compressor type RR20100, b) For M/s ELGI make compressor Type RR20100CGM model, the total length of CP delivery hose pipe should be more as compared to other models. When using this model of CP with existing delivery hose pipe, extension of delivery hose by providing additional nipples and elbows at both ends should be done to avoid hose pipe rubbing with pipeline. c) <b>Hence, standard delivery hose pipe length should be mentioned in the specification.</b></p>	<p><b>ADDED:</b> hose pipe for use on delivery side should be of Reinforced Rubber Hose to SAE 100 RI/R2 standard. Same has been incorporated in clause no. 4.2.3.</p> <p>Firm's to comment on 4.2.4</p>
5.0	<b>DRIVE</b>			
5.1	The motor shall be as per the RDSO specification no. E-10/3/09 (Motor) with	M/s ELGI	No comments received	
		M/s AIML	Accepted	Noted

	latest amendments for 3 phase induction motors for driving auxiliary machines of Electric Locomotives. Motors used to drive Compressor shall be of make and type approved by RDSO. Class of protection for motor compressor set should be IP 55 and for Terminal Box it should be IP 65.	M/s KBIL	No comments received	
		M/s FTRTIL	No comments received	
		RLY/LGD	The motor mounting bed thickness shall be increased to avoid cracks in motor bed. M/s CGL motors (MCP) having bed thickness less and bed cracks, experienced.	On the basis of complaint by Railways, firm is advised accordingly. Railways to comment.
7.3.4	<p><b>ENDURANCE TESTS</b></p> <p>Endurance test is a continuous test and shall be carried out by running the compressor with compressor delivery pressure at 10.2 kg/cm<sup>2</sup> running at rated speed. The test shall be of 400 hours duration. Following measurements shall be made during the endurance tests at intervals of one hour:</p> <p>(i) Delivery Pressure  (ii) Ambient temperature.  (iii) Suction air temperature.  (iv) Speed (rpm).  (v) Inter cooler pressure  (vi) Intercooler and After cooler inlet &amp; outlet temperatures.  (vii) LP inlet &amp; out let air temperatures.  (viii) HP inlet &amp; outlet air temperatures.  (ix) Temperature of cylinder heads (L.P &amp; H.P) &amp; Valve caps, where fitted.  (x) Temperature of crank case.  (xi) Motor body temperature  (xii) Inter cooler pressure</p>	M/s ELGI	No comments received	
		M/s AIML	Accepted	Noted
		M/s KBIL	No comments received	
		M/s FTRTIL	Endurance test is a continuous test and shall be carried out by running the compressor with compressor delivery pressure at 10.2 kg/cm <sup>2</sup> running at rated speed. The test shall be of 400 hours duration. <u>If, endurance test already performed for similar applications, it is not required to be repeated. The relevant Endurance report (or copy of certificate) shall be submitted to RDSO.</u>	M/s FTRTIL comments are not relevant.
		RLY/SCR	The rubber components ('O'rings / gaskets) used at LP / HP should be capable of with-standing the high operating temperature & pressure existing at these locations.	Noted  Railways to comments

	(xiii) Voltage ,current Power Frequency (Hz)		They should not get expanded or become brittle over a period of service (before due date of overhauling) <b>Note:</b> In M/s FTIL make compressors 'O' rings Part No. 850720000 are failing frequently as they are not able to with stand at High pressure.	
7.3.7	<b>WEIGHT:</b> The weight of the complete set of compressor and Motor shall be taken.	M/s ELGI	No comments received	No comments
		M/s AIML	Accepted	No comments
		M/s KBIL	No comments received	No comments
		M/s FTRTIL	No comments received	No comments
		RLY/LGD	As per ROSO SM! No 242 Rev2" dated 31.12.2018, the basic details of FTIL and ELGI CP's with regard to weight of compressor and motor unit are as follows: a) Original weight of imported motor compressor set of D & M type 2A320D two stage 3 cylinder compressor was 535 kgs. After provision of cooling fan, weight increased to 560 kgs. After modification of bracket assembly the weight increased to 700kgs. As per para no 2.4 of above SMI, FEA of compressor mounting lugs was done by M/s ABB taking a weight of motor compressor unit of 535 kgs. After strengthening of mounting bracket no mention of FEA was made. <b>In view of above, SCR desires</b>	One new clause has been added in 10.7 for FEA analysis and Shock & vibration test. Because compressors are fitted in under slung condition.  Comments may be given by Firm's/Rlys.

			<b>that the total weight of the compressor and motor unit should be standardized keeping in view the failures of compressor lugs and high speed train operation.</b>	
8.2	At least 10% of the total lot of compressor on order, selected at random, shall be subjected to a run of 48 hours with 30 minutes shut off at 8 hours interval, at the maximum rated speed and 10.2 kg/cm <sup>2</sup> pressure.	M/s ELGI	No comments received	
		M/s AIML	Accepted	Noted
		M/s KBIL	No comments received	
		M/s FTRTIL	<del>At least 10% of the total lot of compressor on order, selected at random, shall be subjected to a run of 48 hours with 30 minutes shut off at 8 hours interval, at the maximum rated speed and 10.2 kg/cm<sup>2</sup> pressure.</del> <b>This clause to be removed.</b> <b>FT explanation:</b> During proto type test, all the requirements are tested. After completion of type test requirements, Compressor released for Serial production. However, if any major design changes, Type test will be recommended	Not agreed, it is necessary for compressor testing.
		RLY/SCR	No comments	
		M/s AIML	Accepted	
		M/s KBIL	No comments received	
		M/s FTRTIL	No comments received	

		RLY/LGD		
13.0	<b>SPECIAL CONDITIONS:</b>			
13.2	<b>Field Trial:</b> After successful completion of the type test the compressor shall be subjected to extended field trial for a minimum period of six months before according the prototype approval.	M/s ELGI	No Comments	Clause has been modified. And one feedback format has been prepared as Annexure.
		M/s AIML	Accepted	
		M/s KBIL	No Comments	
		M/s FTRTIL	No Comments	
		RLY/SCR	No comments	
14.0	<b>MOUNTING AND LIFTING ARRANGEMENTS :</b>			
14.1	Three point mounting arrangement with proven design damping preferably of metallic helical coil type under slung condition and four point mounting arrangement with proven design damping in onboard condition. The resilient mounts shall be suitable for absorbing the vibration generated on the compressor and motor size. The diameter of helical coils may be kept in accordance to the motor & compressor side.	M/s ELGI	No comments received	This may be considered after comments from Firm's/Rlys.
		M/s AIML	Accepted	
		M/s KBIL	No comments received	
		M/s FTRTIL	Three / Four point mounting arrangement shall be provided is required with proven damping design and suitable vibration absorption characteristics. preferably of metallic helical coil type in under slung condition and four point mounting arrangement with proven damping design in onboard condition. The mounts shall	



			be suitable for absorbing the vibration generated on the compressor and motor size.	
		RLY/SCR	(a) As per the experience gained, the average life of anti-vibration mounts of M/S ELGI make CP is 18months and the average life of anti-vibration mounts of M/s FTIL is 36 months.  (b) As per para 4.1 (e) of ROSO SMI No 242 Rev2 date 31.12.2018, for M/S FTIL make CP the hardness of rubber mounts used is 70-74 HRD for motor end mount and 40-44 HRD for compressor end mount whereas for M/s ELGI make CP the hardness of rubber mounts used IS 80HRD for motor end and 60 HRD for compressor end. In view of above, the hardness of rubber mounts should be standardized respective of the make of compressor and also <b>the mounting pads designed should serve for at least 4years for WAP-7 and 6 years for WAG-9 (10H periodicity)</b>	Shelf life of rubber mount is mentioned in SMI 242 Rev 2.  Firm's to comment on SCR comment.
14.2	The compressor and its mounting arrangement shall be of robust design for traction duty and shall withstand satisfactorily the vibration and shocks normally encountered in service. Mounting arrangement of the compressor motor set shall be suitably for mounting in the existing electric locomotives.	M/s ELGI	No comments received	Now, FEA analysis and shock & vibration has been incorporated in revised specification. In clause no. 10.7.
		M/s AIML	Accepted	
		M/s KBIL	No comments received	
		M/s FTRTIL	No comments received	
		RLY/SCR	a) In the draft specification, the amount of shocks and vibrations to which the concerned	

			<p>equipment is exposed is not mentioned as done for other equipment of the locomotive.</p> <p>b) Since the compressor is common for both passenger and freight locomotives, the amount of shocks and vibrations to which the compressors exposed during service while running mail/express trains at speeds above 140kmph is to be clearly mentioned so as to avoid failures of mounting brackets (lugs), hard and soft mountings on account of heavy vibrations,</p>	
14.6	The compressor shall also be provided with suitable safety slings to prevent it from falling down in case of failure/breakage of the under slung mounting arrangement	M/s ELGI	No comments received	<p>The envelop size has been incorporated in clause no. 14.7 in final draft specification of oil lubricated compressor for under slung in Electric locomotives.</p> <p>Firm's/Rlys to comment.</p>
		M/s AIML	Accepted	
		M/s KBIL	No comments received	
		M/s FTRTIL	No comments received	
		RLY/SCR	<p><b>NEWLY ADDED:</b></p> <p><b>14.7</b></p> <p>(a) As per item no 7.3 of draft rdso specification no rdso/2008/EL/SPEC/0076 rev '2' dated august 2013 for 1750rpm oil free compressor for 3-phase electric locomotives and WAP-4 type of electric locomotives with modified cab &amp; fed by 180 KVA SIV, the overall dimensions for mounting of compressor in three phase locomotives shall be preferably fall within the limits of motor unit in WAP-4</p>	

			<p>locomotives shall be preferably fail within the limit of length=1400mm,width =640 mm and Height =600 mm.</p> <p>(b) Similarly, since the draft specification for 1750 LPM Oil Lubricated Compressor is common for both 3-phase and conventional locomotive applications (as mentioned at items no. 1.1,1.2 &amp; 14.1), <b>it becomes mandatory to specify the standard envelope dimensions within which the complete unit (compressor and motor) is to be designed.</b></p> <p>(c) Specifically for conventional electric locomotives (WAP-4) provided with crew friendly cab modification, SIV and Tri-Plate pneumatic panel, the available space in machine room is limited. For such locomotives, care should be taken that the mounting envelop (frame) for compressor/motor should be the same ,having provision for both under-slung (three point arrangement) as well as on-board mounting (four -point arrangement)</p>	
17.0	<b>HARDWARE:</b> Hardware like high tensile fasteners, spring washer etc shall be from RDSO's or CLW's approved sources. Prior approval shall be taken from RDSO or CLW , if other	M/s ELGI	No comments received	No comments
		M/s AIML	Accepted	
		M/s KBIL	No comments received	
		M/s FTRTIL	<del>Hardware like high tensile fasteners,</del>	Not accepted,

	makes are proposed to be used.		<del>spring washer etc shall be from RDSO's or CLW's approved sources. Prior approval shall be taken from RDSO or CLW, if other makes are proposed to be used.</del> <b>This Clause to be removed.</b> <b>FT explanation:</b> Hardware requirements may please be left to supplier to select the type of fasteners requirement based Compressor performance.	Hardware should be taken from RDSO/ CLW approved vendors only .
		RLY/LGD	No comments	Noted
18.0	<b>FINISH:</b> The compressor motor set shall be suitably treated to remove rust and should be coated with antirust primer and finished with two coats of black paint as per IS 5:1994.  Compressor cylinders are required to be painted by special black heat resisting enameled paint formulated on a modified silicon resin to withstand temperature up to 3500 C.	M/s ELGI	No comments received	
		M/s AIML	Accepted	Noted
		M/s KBIL	No comments received	
		M/s FTRTIL	<del>The compressor motor set shall be suitably treated to remove rust and should be coated with antirust primer and finished with two coats of paint as per IS 5:2007. Compressor cylinders are required to be painted by special heat resisting enamelled paint formulated on a modified silicon resin to withstand temperature up to 350 DEG C.</del> The Compressor motor set and Cylinders shall be suitably treated to fulfill 500 hours of Salt spray test requirements	<i>Not relevant.</i>
		RLY/LGD	No comments	