



भारत सरकार  
रेल मंत्रालय

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**

डीजल लोकोमोटिव में लगाने वाले लांग लाइफ स्नेहक  
आयल फिल्टर एलीमेंट  
**LONG LIFE LUBRICATING OIL FILTER ELEMENT  
FOR LOCOMOTIVE DIESEL ENGINES**

विशिष्ट संख्या एम.पी.0.2600 – 15 (संशो.– 05)  
मार्च– 2021

**SPECIFICATION NO. MP.0.2600 - 15 (Rev. - 05)  
MARCH - 2021**

अनुसंधान अभिकल्प एवं मानक संगठन  
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LONG LIFE LUBRICATING OIL FILTER ELEMENTS FOR LOCOMOTIVE  
DIESEL ENGINES1. SCOPE

- 1.1 Lube oil filter is a critical item affecting the life of power pack on locomotive. This specification is for the 'lube oil disposable filter elements' for use on the ALCO/DLW built diesel locomotives having useful life of 244 days with on board Centrifugal Lube Oil Cleaner (CLOC).

2. CONSTRUCTIONAL FEATURES

- 2.1 The filter element should conform to fitment dimensions given on drg. No. SKDP-3383 (latest revision). Vendor's drawing approved by RDSO in conformance to RDSO drawing is also acceptable.
- 2.2 Structural strength of the element should be such that the element shall
- 1) Not be damaged by handling during transportation and installation,
  - 2) Not collapse in service and
  - 3) Not permit the lubricating oil to by-pass the filter paper.
- 2.3 The filter paper shall be corrugated, impregnated with suitable resin on both sides and cured. The filter paper should have a good dirt or contaminant retention efficiency. The mean pore size shall be  $14 \pm 2$  microns and max. pore size 45 microns. The paper shall not have a tendency to migrate into the lubricating oil system during service.
- 2.4 The filter paper pleats should be uniformly distributed around the centre tube and should be suitably joined together so as not to permit any flow of oil through the joint.
- 2.5 The paper pleats shall be encircled by flexible cotton netting bonded to the peaks of the pleats by suitable adhesive and holding the pleated cylinder tightly. In case the netting is not of endless type, the ends of the cotton netting shall form a minimum 100 mm lap joint adequately bonded. The cotton netting shall cover not less than the middle  $2/3$  of the length of the filter body. Alternatively, cotton/synthetic thread pleat stabilizers bonded around the filter pleats in spiral form may be used in place of cotton netting. Any other arrangement for pleat holding is also acceptable, subject to prior approval of RDSO.
- 2.6 The perforated outer wrapper shall be made from a high density paper with a minimum burst strength of 3.5 kg/cmsq. It shall be perforated with round / square holes as indicated on drg. No. SKDP-3383. The area of perforations being 20 to 25% of the area of the paper, excluding the unperforated zones. The outer wrapper shall firmly enclose the pleated paper, the ends of the wrapper forming a lap joint of at least 12 mm, suitably bonded together.
- 2.7 The metal centre tube shall be made from minimum 0.4 mm thick cold rolled steel sheet to IS:513 Grade O, suitably tin or cadmium or zinc plated on both

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sides. The joint shall be spot welded with a minimum pitch of 25 mm. The centre tube shall be suitably perforated so as to provide an area of flow around 20-25% of the unperforated tube area. The centre tube shall be reinforced with 2.5 mm dia (min) hard drawn steel spring wire to IS: 4454 (Pt.1) grade II.

- 2.8 Alternatively, centre tubes made out of perforated steel tube of adequate thickness and with spiral grooves may be used without reinforcing spring.
- 2.9 The end caps and extension pieces shall be made of minimum 0.4 mm thick steel sheet to IS: 513 Grade-D. All metallic items shall have the same plating material as indicated in clause 2.7. However, the springs (item no. 11) shall not be plated.
- 2.10 The end caps shall be bonded by a suitable adhesive to the pleated paper. The bonding material shall fill the end caps to a minimum depth of 5 mm in finished condition.
- 2.11 The synthetic rubber gasket provided at the bottom end cap extension piece shall conform to the requirements for nitrile compound with shore 'A' hardness  $85 \pm 5$ .
- 2.12 The filter paper, the cotton netting and the perforated outer wrapper should not become brittle or rupture or get otherwise affected by hot engine oil at usual operating temperatures in service upto a period of 250 days. The normal temperature of oil in service will be about 95°C but it can rise to about 150°C at times. There is a possibility of presence of water and diesel oil in the lubricating oil.
- 2.13 The bonding materials and other material used in the construction of the filter shall neither affect nor be affected by hot engine oil in locomotive service at operating temperatures for a service period which may extend upto 250 days.

### 3. PERFORMANCE REQUIREMENTS

#### 3.1 Fabrication Integrity

Fabrication integrity of the filter element shall be verified as per test method described in IS: 8383 or ISO: 2942. The test fluid for this test shall be clean and filtered HSD oil at room temperature between 15 to 40°C. No evidence of persistent stream of bubbles shall be visible from the end caps area bonded with adhesive and filter paper area or paper pleat joint, prior to foam coming out from the paper pores. The air pressure shall be applied till the foam starts coming out from the paper.

The foam from filter paper pores should not come out upto a pressure of 15 cms of water gauge (min).

#### 3.2 End load test

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A tensile load of 20 kg applied at the end caps of the filter elements for 5 minutes shall not cause any damage.

3.3. High temperature test

The filter element shall be soaked in engine oil maintained at a constant temperature of  $130^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for a period of 24 hours. The filter shall be subjected to end load test before it cools down below  $70^{\circ}\text{C}$ .

3.4 Pressure drop Vs flow rate

The filter element shall be tested for determining its pressure drop Vs flow rate characteristics on a standard lubricating oil filter test rig (as per Drg. No. SKDP-3021) approved by RDSO. The test oil shall be a 20W40 engine oil of approved brand by RDSO for use on DLW engines. With clean oil at a temperature of  $80 \pm 2^{\circ}\text{C}$ , the flow capacity of the filter element should be minimum 150 litres/minute with pressure drop not exceeding  $0.4 \text{ kg/cm}^2$  across the element. The pressure drop Vs flow rate characteristics shall be determined upto a flow of 400 litres/min., readings being taken both for ascending and descending order of flow.

3.5 Filtering Efficiency and Rig Life

The filter element shall be subjected to a filtering efficiency and rig life test on the same test rig as used for Pressure drop Vs Flow rate test using the same test oil. The flow rate shall be maintained at  $270 \pm 5$  litres/min. throughout the test. The standard test dust shall conform to SAE J726 FINE (imported). The test dust slurry additions shall be made with 11.96 gms of dust in 50 cc of test oil and added to the sump at intervals of 30 minutes. The test shall be continued till a pressure differential of  $1.4 \text{ kg/cm}^2$  is built up across the filter element. Rig life shall be the number of additions of contaminant required to build  $1.4 \text{ kg/cm}^2$  pressure differential. The cumulative filtering efficiency during the test and rig life shall not be less than those indicated below:

.1) Cumulative filtering efficiency (min.) - %

40	after 4 <sup>th</sup> addition of dust
65	after 16 <sup>th</sup> addition of dust
75	after 32 <sup>nd</sup> addition of dust
90	at the end of rig life.

.2) Rig life (min.)                      48                      addition of test dust.

3.6 Test for Ability to Withstand High Pressure Differential

The cumulative efficiency and rig life test shall be continued further by addition of contaminants as necessary till a pressure differential of  $7 \text{ kg/cm}^2$  is reached (irrespective of flow rate) and maintained for at least 5 minutes.

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### 3.7 Test to Establish Resistance to Water contamination

3.7.1 This test is designed to assure that pleat collapse and premature plugging does not occur when the lubricating oil is contaminated with water. The test method is basically the same as for the Pressure drop Vs Flow rate test under clause 3.4 with the following difference:-

- .1) Use minimum 200 litres of oil in the sump.
- .2) After completion of the normal flow rate Vs pressure drop test add 1% water (by volume) in the sump oil and mix it by circulating the oil water mixture through the by-pass circuit for at least 10 minutes. Pass the contaminated oil through the filter for 15 minutes and stop.
- .3) After cooling to about 45°C, reheat back to 80°C and circulate the oil-water mixture through the filter for a period of half an hour.
- .4) Repeat the flow rate Vs pressure differential test and plot in the form of a graph.

3.7.2 The pressure differential characteristics for the contaminated oil should not be substantially higher than the one obtained with un-contaminated oil. An increase in pressure differential of 0.2 kg/cm<sup>2</sup> at 300 litres/minute flow shall be taken as the limit of increase in pressure differential due to effect of contaminated oil.

### 3.8 Field Performance

#### 3.8.1 Type tests

As a part of type-testing, filter elements will be subjected to field service trials as per the test scheme issued by RDSO attached as **Annexure - III**. The data recorded during trials shall be analysed by RDSO to judge acceptability or otherwise of the filters under test.

#### 3.8.2 Minimum service life requirement

Field trial would be conducted on 10 locomotives fitted with CLOC at two different diesel loco sheds i.e. a minimum of 80 no. of Lube oil filter elements would be required for field trial.

During field trial on ALCO/DLW locomotive the filter element should provide satisfactory filtration for a minimum period of 250 days in service with CLOC regardless of oil age, condition or other factors i.e. under worst conditions in service. There is a possibility of the oil in normal service being contaminated with water and diesel oil. Oil temperatures rises normally upto 90°C & for a brief period upto 150° C.

### 4. Approval Requirements

The product offered shall be of or from established and reputed manufacturers, who are in line of manufacturing the filters of similar design and have a

proven record of their media performance on any established Rail Road System to ensure consistent quality & reliability. The documents in its support shall be furnished while submitting any offer.

The capability of the filter manufacturer for manufacture and supply of good quality filters on consistent basis shall be assessed before the samples are accepted for evaluation. The minimum requirements of quality control and manufacturing facilities are indicated in Annexure I.

4.1 Filter paper

4.1.1 The filter manufacturer shall declare the grade/type and make of filter paper used in the filter element and its mean and max pore sizes.

4.1.2 The cured filter paper used in the construction of the element shall be tested for the following properties and any additional properties that may be specified in this regard from time to time, at an approved laboratory and test results furnished to the RDSO, before issue of the approval for regular supply of filters to Railways (Ref.clause 4.7).

Sl. No.	Properties	Test method/standard
1.	Basis weight	IS-1060 Pt. I
2.	Thickness	IS-1060 Pt. I
3.	Corrugation depth	Optical micrometer
4.	Tensile strength (dry) min. a) Machine direction b) Across machine	ISO-1060 Pt.I
5.	Burst strength (min)	ISO-1060 Pt. I
6.	Mean pore size	As per AAR Bubble Point test method/ASTM F-316/03 (2011)*
7.	Max. pore size	As per AAR Bubble Point test method/ASTM F-316/03 (2011)*

\*ASTM F-316/03 (2011) **OR** corresponding Indian Standard to be referred.

4.1.3 Any new grade/type of filter paper (other than that approved by RDSO) proposed to be introduced for this application, shall require approval of RDSO.

4.2 Filter element

On preliminary acceptance of the filter paper by RDSO, filter elements made out of it shall be subjected to type tests as specified below:

4.2.1 Physical and dimensional checks on the filter elements.

4.2.2 Following tests on filter elements in the sequence indicated below:

First filter element

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- End load test (clause 3.2)
- Fabrication integrity test (clause 3.1)
- Pressure drop Vs Flow rate test (clause 3.4)
- Resistance to water contamination (clause 3.7)

Second filter element

- End load test (clause 3.2)
- Fabrication integrity test (clause 3.1)
- Filtering efficiency and rig life test (clause 3.5)
- Test for ability to withstand high pressure differential (clause 3.6)

Third filter element

- End load test (clause 3.2)
- Fabrication integrity test (clause 3.1)
- High temperature test (clause 3.3)
- End load test (clause 3.2)
- Fabrication integrity test (clause 3.1)

- 4.3 All the above type tests shall be done at the RDSO's laboratory and recorded as per **Annexure - II**.
- 4.4 One of the filters offered, for type testing on test rigs and/or fields service, in a lot shall be cut open for inspection of the constructional details and verification, at an approved laboratory, of the paper properties listed under clause 4.1.2.
- 4.5 If the results of the above tests are found acceptable, filter elements shall be subjected to field trials as per test scheme issued by RDSO to evaluate their service performance (**Annexure – III**). Field trials shall be conducted on at least ten locomotives in two diesel sheds
- 4.6 The filter manufacturer shall be cleared for regular supply of long life lube oil filters to Railways when it is established, by extended service trials that filter element meets the requirement of service life stipulated in clause 3.8.2. The manufacturer shall furnish all the properties of filter paper listed in clause 4.1.2, before issue of such approval, for verification of future supplies and shall be made part of QAP.

Qualifying Quantity and period for field trial and up-gradation will be governed by (latest version) of RDSO ISO Document No. MP-M- 8.1-1 (Master List of Qualifying Quantity for up-gradation to approved vendors and Qualifying Quantity & Qualifying Periods for Approval for RDSO vendor for developmental order of items controlled by MP Directorate).

- 4.7 On satisfactory completion of all the above type tests, the manufacturer will be required to give an undertaking that all filters offered subsequently by him against the specification will be made from the same filter paper identical in all respect to that used on filters subjected to tests for approval.

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5. Inspection

- 5.1 For each lot of supply, the manufacturer shall submit a certificate to the purchaser/inspector along with the particulars of the paper manufacturer, manufacturer's identifying code or grade or marking, certifying that the filters being offered are made from a paper identical in all respects to the one which had been approved by RDSO under requirements of clause 4. If required, documents shall be made available, for examination by purchaser/inspector, to establish the source and grade of paper.
- 5.2 The paper used in the manufacture of filter shall be tested for properties listed in clause 4.1.2 and any other properties that may be stipulated from time to time in this regard by RDSO, or any other checks considered necessary by the purchaser/inspector to verify the claim regarding the filter paper being identical to the one approved under clause 4. The inspector shall be free to draw samples of paper during the course of manufacture of the lot of filters. In case the paper is imported, one test per lot shall be done. The manufacturer shall provide all facilities available with him to test such samples. If facilities are not available, RDSO would send the sample for testing to an approved laboratory.
- 5.3 The filter elements offered for supply shall be subjected to 1% check out of the lot in respect of the various physical and dimensional requirements of this specification (Clause 4.2.1).
- 5.4 A minimum 1 check in 5000 filters, subject to at least one check per lot of supply, shall be made in respect of tests listed in clauses 4.2.2. Results in respect of the filtering efficiency and rig life test shall meet the minimum requirements of clause 3.5. These tests shall be carried out at a laboratory.
- 5.5 The samples for checks and testing shall be selected by the inspector at random from filters offered in one lot.
- 5.6 All filters constituting the lot rejected on the basis of inspection shall be marked suitably by the Inspector so as to prevent their being offered again to Indian Railways against this specification. The method of marking shall be at the option of the purchaser/inspector.
- 5.7 The manufacturer shall, at his own cost, supply samples, labour and appliances and arrange for carrying out of the tests as may be necessary. The manufacturer shall bear the cost of carrying out tests etc. at approved test house or laboratory as may be required by purchaser or inspector.
- 5.8 The purchaser, inspector or their representatives shall have free access to the works of the manufacturer at all reasonable times. They shall be at liberty to inspect the manufacture at any stage and to reject any material that does not conform to the terms of this specification.
- 5.9 RDSO shall draw random samples of filter elements from supplies made to Diesel Sheds by approved manufacturers periodically and subject them to detailed testing as indicated in clause 5.4. In case, the quality of filters



supplied does not conform, within the reasonable tolerances, to the quality obtained at the time of approval (type tests), the approval shall be liable to be withdrawn.

6. Marking

Name of the manufacturer shall be embossed on the end cap as given in the drawing no. SKDP-3383. Other particulars, viz. month and year of manufacture, batch number, serial number and specification to which it conforms shall be marked in indelible ink on the non-perforated zone of outer wrapper.

7. Packing

To avoid damage of filters during transit and storage, each filter element shall be separately packed in poly bags. Eight such poly packs shall then be placed in a master crate made out of 5 ply corrugated board, having separate compartment for each filter pack. The master crate shall then be properly sealed from all sides.

8. Warranty

The supplier shall furnish a warranty that if the service life obtained during normal use on the locomotives is less than 244 days, all filter elements belonging to that particular batch will be replaced by him free of cost.

9. Vendor Changes in Approved Status

All the provisions contained in RDSO's ISO procedures laid down in document no. QO-D-8.1-11, dated 01.07.2020 or latest (Titled "Vendor - changes in approved status) and subsequent version/amendment thereof, shall be binding and applicable on the successful vendor/vendors in the contract floated by Railways to maintain quality of products supplied to Railways.

10. Preference to Make In India

The Government of India policy on `Make in India` shall apply.

11. The revised specification shall be implemented from **1<sup>st</sup> May – 2021**.

**Annexure-I****MINIMUM REQUIREMENTS OF MANUFACTURING AND QUALITY CONTROL FACILITIES FOR PLANTS MANUFACTURING PLEATED PAPER TYPE FILTER****1. MANUFACTURING EQUIPMENTS/FACILITIES**

1. Pleating machine (In case the media is procured in Rolls).
2. Heating stations and fixtures for curing of end caps, cotton netting, outer wrapper and end joints of outer wrapper.
3. Arrangements for joining of the ends of the pleated media.
4. Curing oven for filter media.

**2. QUALITY CONTROL FACILITIES**

2.1 Equipments for the testing of filter media for the following properties:-

<u>Property</u>	<u>Test method</u>
1 Thickness	IS: 1060 Part I
2 Basis weight	IS: 1060 Part I
3 Corrugation depth	Optical micrometer
4 Tensile strength	IS: 1060 Part II
5 Burst strength	IS: 1060 Part I
6 Mean & max. pore size	AAR Bubble Point test method / ASTM F-316/03 (2011)*

\*ASTM F-316/03 (2011) **OR** corresponding Indian Standard to be referred.

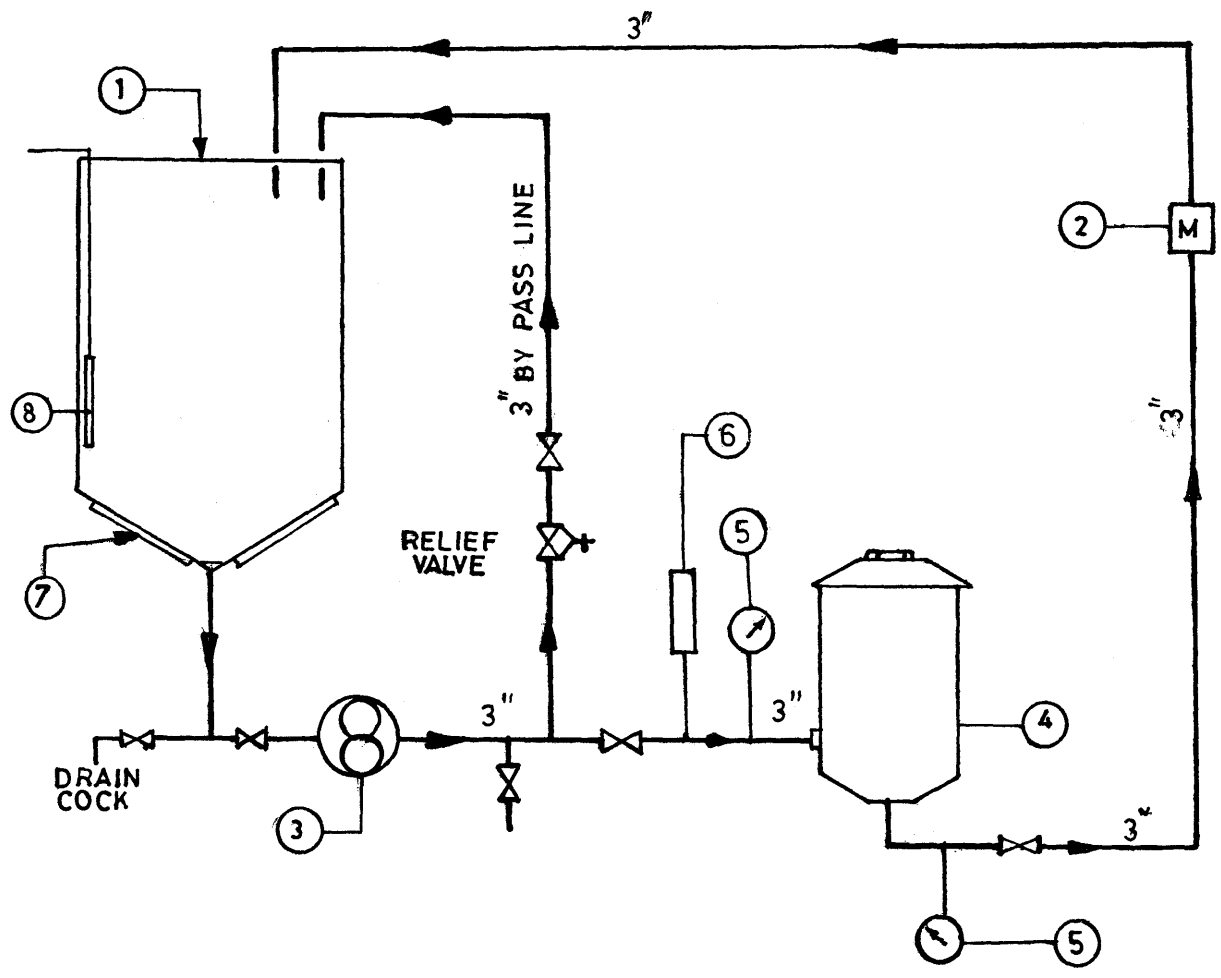
2.2 Equipments and test rig for inspection and testing of filter elements as per relevant RDSO specification for:

1. Physical and dimensional checks.
2. Fabrication integrity
3. End load test
4. High temperature test.
5. Pressure drop Vs flow rate characteristics
6. Filtering efficiency and rig life
7. Resistance to water contamination
8. Ability to withstand high pressure differential

2.3 Adequate organisation and equipments for inspection of components like end caps, spring and gaskets.

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Note: A filter manufacturer may not have these facilities at the time of submitting application for registration. However, these facilities must be created before issue of approval letter.



PUMP DATA:-

CAPACITY : 314 G.P. M.  
PRESSURE : 8 kg / cm<sup>2</sup> (MIN.)

8	THERMOSTATE	1
7	HEATING COIL	-
6	THERMAMETER	1
5	PRESSURE GAUGE	2
4	FILTER HOUSING	1
3	PUMP	1
2	FLOW METER(0-500 L/MIN.)	1
1	RESERVOIR -400 LITRES	1
REF NO.	DESCRIPTION	NO. OFFL

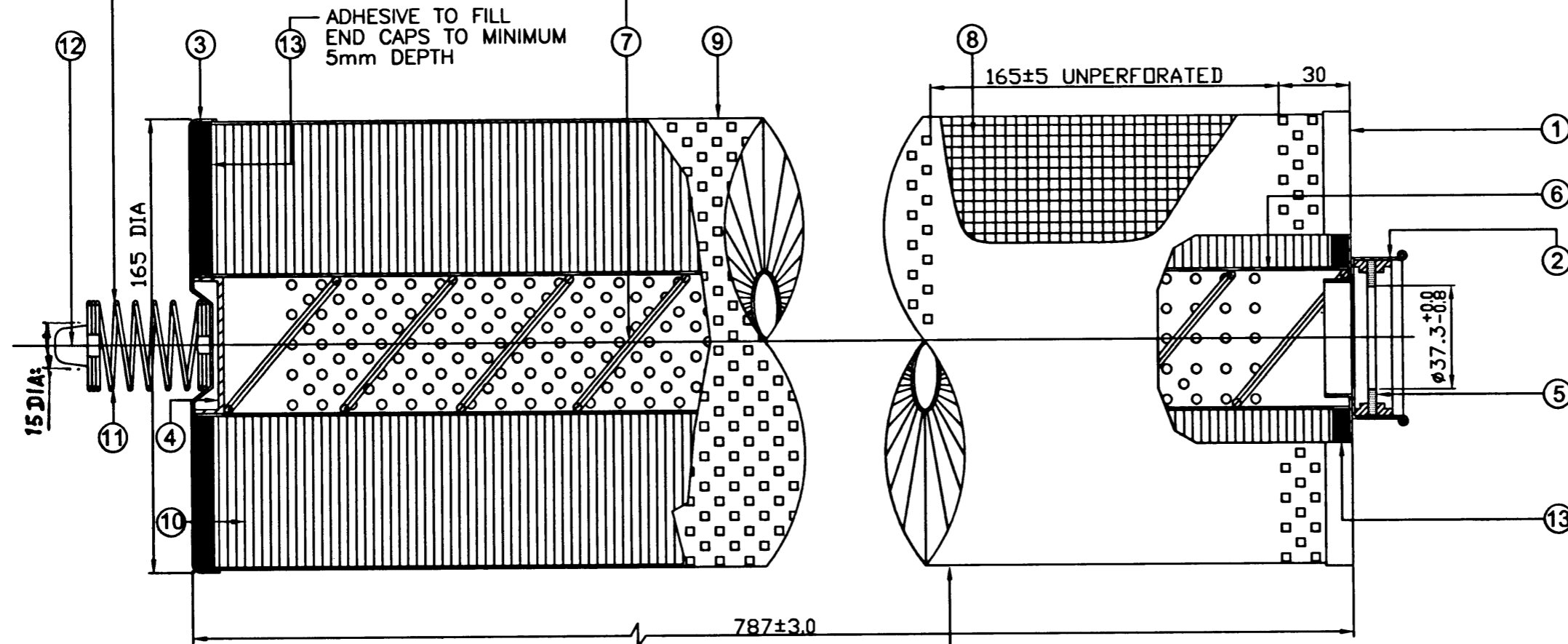
D  
T  
C  
TC  
APPD.  
DT 24.11.92

SCALE :-	REF :-
N.T.S.	DRG. NO. SK.DP-3021
FIRST ISSUE	SUPERSEDES SUPERSEDED BY:-

**SPRING DATA**

WIRE DIA, 2.5mm  
 OUT SIDE DIA. 33mm  
 NO. OF COILS 4 1/2 TIP TO TIP  
 FREE HEIGHT 43mm

**REINFORCING SPRING**



TO BE MARKED BY INDELIBLE INK ON OUTER WRAPPER  
 MANUFACTURED BY.....  
 BATCH NO..... (MONTH YEAR)  
 SERIAL NO.....  
 SPECIFICATION NO.....  
 FILTER MEDIA GRADE.....

13.		ADHESIVE	-	-	-
12.		NIPPLE	1		STEEL SHEET TO IS:513-D
11.		ADOPTER SPRING	-		SP. ST. WIRE IS:4454Pt:1Gr:2
10.		FILTER MEDIA CORRUGATED	-		SEE CL. 2.3 OF SPEC.
9.		OUTER WRAPPER (PERFORATED)	-		HIGH DENSITY PAPER
8.		COTTON NETTING	-		-
7.		REINFORCING SPRING	1		SP. ST. WIRE IS:4454Pt:1Gr:2
6.		CENTRE TUBE	1		STEEL SHEET TO IS:513-O
5.		GASKET	1		NITRILE RUBBER
4.		PRESSURE PLATE (OPTIONAL)	1		STEEL SHEET TO IS:513-D
3.		TOP END CAP	1		STEEL SHEET TO IS:513-D
2.		BOTTEM EXTENSION ASSLY.	1		STEEL SHEET TO IS:513-D
1.		BOTTEM END CAP	1		STEEL SHEET TO IS:513-D
REF NO	I R PART NO	DESCRIPTION	NO OFF	WT(kg) EACH	MATL & SPEC

APPLICABLE FOR		<b>LONG LIFE LUBE OIL FILTER ELEMENT</b>		
SCALE N.T.S.	REF:	INDIAN RLYS DRG. NO. SKDP-3383		FIRST ISSUED
1	4	DRG. REVISED & REDRAWN.	L3-68	11-3-05
ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.
				SIGN DATE
				RDSO (MP)
				SUPERSEDES SUPERSEDED BY

D R.K.SRIVASTAVA  
 C *SKD*  
 APPD. *A. gnu*  
 Dt 11-03-2005

$\overline{\text{R}}$	50	
$\nabla$	25	
$\text{VV}$	6.3	
$\text{VVV}$	0.8	*SURFACE ROUGHNESS TO IS:3073
$\text{VVVV}$	0.1	WELDING SYMBOLS TO IS:813
SYMBOL	Ra <sub>um</sub> (MAX.)	TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS: 2102 (Part I)-COARSE

1	4		DRG. REVISED & REDRAWN.	L3-68	11-3-05
ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.	SIGN DATE

*25/03/05*

**Test Plan/Check sheet for Type Test /Purchase Inspection of Long Life Lubricating Oil Filter Element for Locomotive Diesel Engines  
as per RDSO Specification No. MP.0.2600-15 and Drawing No. SKDP – 3383**

**A. Dimensional check :**

SN	Para No. of Specification	Dimension Description (Ref: RDSO Drg. No. SKDP – 3383 (Alt. – 1))	Specified Value (mm)	Observed Value (mm)	Remarks (OK/NOT OK)
1.	2.1	Total Length	787 ± 3.0		
		Outer Diameter	165 ± 1.2		
		Inner Dia. of Gasket	37.3 (+0/-0.8)		
		Distance from Bottom End Cap to perforation	30± 0.5		
		Length of un-perforated area (starting from 30mm from bottom)	165 ± 5		
		Depth of Adhesive filling End Caps	5 (min.)		
		Nipple Diameter	15 ± 0.5		
		Spring Wire Diameter	2.5 ± 0.2		
		Spring Outer Diameter	33 ± 0.8		
		Free Height of Spring	43 ± 0.8		
		No. of Coils (Tip to Tip)	4 +1/2		
		Manufacturer Mark with Indelible Ink (on outer wrapper).	[Mfg. by, Batch No. (Month/Year), Sl. No. , Spec. No. & Filter Media Grade ]		

**B. Visual and physical checks :**

SN.	Test Description	Para No. of Specification	Parameter to be Checked/ Test method	Specified Value (mm)	Observed Value	Remarks (OK/Not OK)
2.	Visual Check	2.4	Condition of filter paper pleats.	OK/ Not OK as per Para 2.4 of the specification		Specify non-compliance, if Not OK
		2.5	Condition of flexible cotton netting or cotton/synthetic	OK/ Not OK as per Para 2.5 of the specification		Specify non-compliance, if Not OK

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			thread pleat stabilizers.			
		2.7 & 2.9	Plating on both sides of metal centretube, end caps and extension pieces.	Tin or Cadmium or Zinc		
3.	Burst Strength of Outer Wrapper	2.6	-----	3.5 Kg/cm <sup>2</sup> (min.)		
4.	Area of perforation of outer wrapper	2.6	-----	20 to 25% of the area of the paper excluding unperforated zone.		
5.	Length of lap joint in outer wrapper	2.6	-----	12 mm (min)		
6.	Material of metal centre tube	2.7	-----	IS:513 Grade O		Attach test report
7.	Thickness of material of metal centre tube	2.7	-----	0.4 mm (min)		
8.	Metal centre tube joint pitch	2.7	-----	25 mm (min)		
9.	Perforated area in Metal centre tube	2.7	-----	20-25% of the unperforated tube area		
10.	Material of center tube reinforcement spring	2.7	-----	Spring Steel Wire IS: 4454 (Pt 1) grade II		Attach test report
11.	Diameter of reinforcement	2.7	-----	2.5 mm (min)		

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	spring wire					
12.	Alternate centre tube (if applicable)	2.8	Alternate centre tube made out of perforated steel tube with spiral grooves may be used without reinforcing spring.	Check thickness of tube material for adequacy.		
13.	Material of end caps and extension pieces	2.9	-----	IS:513 Grade-D		Attach test report
14.	Thickness of end caps and extension pieces	2.9	-----	0.4 mm (min)		
15.	Hardness of nitrile compound synthetic rubber gasket	2.11	-----	Shore 'A' 85±5		

**C. Performance test :**

SN.	Test Description	Para No. of Specification	Parameter to be Checked/ Test method	Specified Value (mm)	Observed Value	Remarks (OK/Not OK)
1.	Fabrication Integrity test	3.1	As per para 3.1 of the specification and test procedure given in IS:8383 or ISO 2942	No visible evidence of persistent stream of bubbles from the end caps area bonded with adhesive and filter paper area or paper pleat joint, prior to foam coming out from the paper pores. The foam from filter paper pores should not come out up to a pressure of 15 cm of water gauge (min).		
2.	End Load test	3.2	Apply tensile load of 20 kg at the end caps of the filter elements for 5 min.	Shall not cause any damage.		

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3.	High Temperature test	3.3	Soak filter element in engine oil maintained at a constant temperature of 130°C ± 5°C for a period of 24 hrs. The filter shall be subjected to end load test before it cools down below 70 ° C	Shall not cause any damage.		
4.	Pressure drop V/s Flow rate	3.4	As per Para 3.4 of the specification. The pressure drop Vs flow rate characteristics shall be determined up to a flow of 400 litre/ min both in ascending and descending order of flow and values to be recorded in the format given in the end of check sheet.	Flow Capacity: 150 liters/min. (Minimum) with max. pressure drop 0.4 Kg/cm <sup>2</sup> across the filter element.		
5.	Filtering Efficiency & Rig Life	3.5	As per Para 3.5 of the specification 1. Cumulating filtering efficiency (min.) % (To be recorded in the format given in the end of check sheet). 2. Rig Life (Min)	After 4 <sup>th</sup> addition of dust: 40 After 16 <sup>th</sup> addition of dust: 65 After 32 <sup>nd</sup> addition of dust: 75 At the end of rig life: 90  48 addition of test dust.		
6.	Ability to Withstand High Pressure Differential	3.6	As per Para 3.6 of the specification	Ability to bear high differential pressure of 7 Kg/cm <sup>2</sup> and maintained for at least 5 minutes.		
7.	Resistance to Water contamination.	3.7	As per Para 3.7 of the specification	Pressure differential with contaminated oil should not increase more than 0.2 kg/cm <sup>2</sup> compared to un-contaminated oil at 300 litres/minute flow.		

**D. Paper properties test :**



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SN.	Test Description	Para No. of Specification	Parameter to be Checked/ Test method	Specified Value	Observed Value	Remarks (OK/Not OK)
1.	Filter paper	4.1.1	Grade/type of filter paper.	Collect the declaration of filter manufacturer regarding make & grade/type of filter paper and its mean and max. pore size.		
2.		4.1.2	1. Basis Weight as per IS-1060 Pt.I	Value as provided/declared by filter manufacturer.		
			2.Thickness as per test method/standard IS-1060 Pt. I	Value as provided/declared by filter manufacturer		
			3.Corrugation depth	Value as provided/declared by filter manufacturer		
			4.Tensile strength (dry) min.as per test method/standard IS-1060 Pt. I a) Machine direction b) Across machine	Value as provided/declared by filter manufacturer		
			5. Burst strength (min.) as per test method/standard IS-1060 Pt. I	Value as provided/declared by filter manufacturer		
			6. Mean pore size as per AAR Bubble Point test method/ASTM F-316/03 (2011)	14±2 microns		
			7. Max pore size as per AAR Bubble Point test method/ASTM F-316/03 (2011)	45 microns		

**E. Other checks :**

SN.	Test Description	Para No. of Specification	Parameter to be Checked/ Test method	Specified Value	Observed Value	Remarks (OK/Not OK)
1.	Undertaking	5.1	Undertaking to be submitted by the firm in compliance to clause 5.1 of the specification	As per Clause 5.1 .		Attach undertaking given by firm.

**N.B.**

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1. All the above tests are to be done during type testing.
2. During type testing, the tests mentioned in clauses 4.2.1, 4.2.2 & 4.4 of the specification shall be done at the RDSO’s laboratory.
3. Purchase inspection:
  - (i) Tests mentioned in (A) Dimension Check & (B) Visual & Physical Check to be carried out on 1% per lot.
  - (ii) Performance tests (clause 4.2.2 of spec.) to be done minimum 1 check in 5000 filters subject to at least one check for each lot of supply.
  - (iii) Paper properties test to be done on the paper used for manufacturing of the lot.
  - (iv) Undertaking to be taken for each lot supplied.

**Pressure Drop Vs Flow Rate (Para 3.4 of the specification)**

Test Oil :  
 Sump Volume :  
 Test Temperature : 80 ± 2° C  
 Test Sample :  
 Test Rig : Lube Oil Filter Test Rig of M/s -----

Ascending Order	Flow Rate (Litre/Minute)	Pressure Kg/cm <sup>2</sup>		Differential Pressure Kg/cm <sup>2</sup>
1	150			
2	200			
3	250			
4	275			
5	300			
6	350			
7	400			
Descending Order				
1	400			
2	350			
3	300			
4	275			

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5	250			
6	200			
7	150			

**Cumulative Filtering Efficiency & Rig Life (Para 3.5 of the specification)**

- Test Oil :
- Sump Volume :
- Test Temperature : 80 ± 2 ° C
- Test Dust : AC Fine Test Dust SAE J726 FINE (Imported)
- Test Dust Addition Rate : 11.96 gms (in 50 CC Slurry)
- Flow rate : 270 ± 5 Litres/Minute
- Test Sample : Long Life Lube Oil Filter Element made using Filter Paper Media of M/s .....
- Test Rig : Lube Oil Test Rig of M/s -----

Dust Addition Sr. No.	Quantity of Dust (Gms)	Pressure Kg/cm <sup>2</sup>		Differential Pressure Kg/cm <sup>2</sup>	Cumulative Filtering Efficiency (%)
		Inlet	Outlet		
0					
1					
2					
3					
4					
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Annexure - III

**Trial Scheme for Field Trial of Long Life Lubricating Oil Filter Element for Alco Locomotives**

- Field trial is to be done in two different diesel sheds.
- The trial filters shall be weighed at the start of trial (New filter) and after soaking for 2 hrs & and draining for 5 hours.
- Fitment Scheme:

Shed	Loco type	No. of Loco	Filter quantity per loco	Quantity to be fitted (No. of Loco*Qty per loco)	Duration of trial
Shed X	Alco loco with CLOC	5	8	40	250 days
Shed Y	Alco loco with CLOC	5	8	40	250 days

- The Data of differential pressure shall be recorded during each Trip Schedule. Lube Oil samples shall also be drawn for analysis to determine the following,
  - Viscosity – Every trip.
  - Insoluble % by weight (Hexane) – monthly
  - Spectrographic analysis – monthly

The details are to be recorded in the following format:

Shed/Rly: .....

SN	Loco No.	Date of last oil change	Filter make	Date of filter put on trial	Date of Trip Schedule	Date of filter removal from trial	Diff. pressure across filter-kg/cm <sup>2</sup>		Lube Oil Condition	Remarks, if any
							Idle	8 <sup>th</sup> notch	Viscosity	

SN	Loco No.	Date of start of trial	Date of sample pickup-Monthly	Insoluble (%) Hexane	Spectrographic analysis	Remarks, if any

- The Trial Filters shall be replaced on conditional basis i.e. when the pressure differential across the filter housing has reached 1.4 Kg/cm<sup>2</sup> (8<sup>th</sup> notch and water temperature of 80±2° C) or trial period is over, whichever is earlier.
- After removal of filter from trial, the following Data shall be recorded by Shed and furnished to RDSO,  
Shed/Rly: .....

SN	Loco No.	Make	Weight of Dry Filter(Kg), (Before trial)	Weight Kg-(A), soak for 2 hrs & drain for 5 hours ( Before trial)	Weight Kg- (B), After draining for 5 hours ( After trial)	Contaminant retained in Kg (B-A)