

SPECIFICATION FOR PLEATED PAPER TYPE TURBO-LUBRICATING OIL FILTER ELEMENT FOR LOCOMOTIVE DIESEL ENGINES

1. SCOPE

1.1 This specification covers two types of resin-impregnated pleated paper type disposable Turbo Lubricating Oil Filter Elements mentioned below, for use on ALCO/DLW Diesel Electric Locomotives:

1. 60 day filter element to RDSO drg. No.SKDP-2694.
2. Long life (92 days) filter element to RDSO drg. No.SKDP-3374.

1.2 The service life mentioned above is the minimum guarantee life to match with quarterly schedule maintenance. The actual life shall be as per clause 3.7.2.

2. CONSTRUCTIONAL FEATURES

2.1 The filter element shall conform to the major overall dimensions indicated in drgs. No.SK.DP-2694 &3374, enclosed herewith.

2.2 Structural strength of the element shall be such that:-

- .1 it does not get damaged in handling during transportation, storage or installation
- .2 it does not collapse in service
- .3 it prevents the lubricating oil to by-pass the filter media.

2.3 The filtering media shall be a refined corrugated paper with mean pore size of 20 ± 2 microns and maximum pore size of 80 microns, impregnated with a suitable resin on both sides and cured. The media shall not have a tendency to migrate in course of service. The filtering media should have good dirt or contaminant retention efficiency.

2.4 The pleats shall be uniformly distributed around the centre tube and shall be suitably joined together by adhesive so as not to permit flow of oil through the joints.

2.5 A perforated 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. The outer wrapper shall be made out from a high density paper with a minimum bursting strength of 3.5 kg/cm.sq. It shall be perforated with round/square holes to provide 20-25% open area.

2.6 The metallic centre tube shall be made out from minimum 0.4 mm thick cold rolled steel sheet to IS:513 Grade 'O' suitably plated on both sides with tin, cadmium or zinc. The joint shall be spot welded with a minimum pitch of 25 mm. The tube shall be suitably perforated so as to provide an area of flow around 20-25% of the unperforated tube area.

2.7 The end caps shall be made out from minimum 0.4 mm thick steel sheet to IS:513 Grade 'D' and shall be tin cadmium or zinc plated.

2.8 The end caps shall be bonded with the pleated paper by a suitable adhesive. The bonding material shall fill the end caps to a minimum depth of 3 mm.

2.9 The filtering media, outer wrapper, bonding material and other material used for construction of filter element shall neither affect nor get affected by hot lubricating oil at usual operating temperatures in service which may extend upto a period of 3 months. The drop in burst strength of the filtering media shall not exceed 22% of its initial value after immersion in hot lubricating oil at 130deg. c for 96 hours. The normal temperature of oil in service is about 95 deg. c but at times it can rise to about 150 deg. c. There is also a possibility of presence of water in the lubricating oil.

3. PERFORMANCE REQUIREMENTS

3.1 Fabrication Integrity

Fabrication integrity of the filter element shall be tested as per test method 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 deg.c. No evidence of persistent stream of bubbles shall be visible from the filter element upto a pressure of 10 cms of water gauge.

3.2 End-load test

A tensile load of 20 kg. Shall be applied at the end caps of the filter element. No damage to the element should result.

3.3 High Temperature Test

The filter element shall be soaked in engine oil and maintained at a constant temperature of 130 ± 5 deg. c for a period of 24 hours. The soaked filter element shall be subjected to end-load test before it cools down below 70 deg. c. No damage to the element should result.

3.4 Pressure drop Vs flow rate characteristics

The filter element shall be tested for determining its pressure drop Vs flow rate characteristics on a standard test rig approved by RDSO. The test oil shall be a SAE-40 engine oil approved by RDSO for use on 251 type diesel engines. With clean oil at a temperature of 80 ± 2 deg. c, the flow capacity of the filter element should be minimum 20 l/min., with pressure drop not exceeding 0.4 kg/cm.sq., with minimum inlet pressure 5.5 kg/cm.sq. The pressure drop Vs flow rate characteristics shall be determined upto a maximum flow rate of 75 l/min., readings being obtained both for ascending and descending orders of flow.

3.5 Filtering Efficiency and Rig Life

The filter element shall be subjected to '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 test

dust shall be AC fine. The test dust slurry (5 gms dust in 20 c.c. slurry) shall be added at 30 minutes interval. The cumulative filtering efficiency with flow rate of 50 l/min. shall be minimum 40% and 65% after 2nd and 6th additions of dust and 85% at the end of rig life. Rig life shall be the time required to build up 1.4 kg/cm.sq. pressure differential across the filter element. The test shall be continued till this pressure differential is built up across the filter element. Results of this test shall be reported in the form of complete characteristics of cumulative efficiency Vs time and pressure differential. The rig life shall not be less than 8 additions of test dust in case of 60 day filter and 12 addition in case of long life (92 day) filter..

3.6 Test for Ability to Withstand High Pressure Differential

The filtering efficiency and rig life test as described in para 3.5 shall be continued further by additions of contaminant as necessary till the pressure differential 2.5 kg/cm.sq. is reached and maintained for atleast 5 minutes. The filter element shall not collapse at this pressure differential. The fabrication integrity test (para 3.1) shall be repeated thereafter.

3.7 Field Service Trials

- .1 Filter elements will be subjected to field service trials as per test scheme furnished by RDSO. The data recorded during trials regarding performance, including filter life, shall be analysed by RDSO to judge acceptability or otherwise of the filters under test.
- .2 During field trials the filter elements shall provide satisfactory filtration for a period of 60/100 days regardless of oil age, condition or other factors. There is a possibility of the oil, in normal service, being contaminated with water. Also, oil temperature upto about 95 deg.c are common, rising upto 150 deg.c for brief periods.
- .3 The life of the filter element is defined as number of days from the date these are put in service to the date when pressure differential across the filters reaches 1.4 kg/cm.sq.

4. APPROVAL REQUIREMENTS

A filter element offered for approval of RDSO, against this specification should have satisfactorily undergone the requirements of the following sub-clauses:-

4.1 Filter Paper

- 4.1.1 The paper used in the construction of the filter 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 the results furnished to RDSO for approval of the filter paper.

Properties	Test Method	Condition of filter paper sample	Acceptable limit (cured paper)
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1.	Thickness (over corrugation) (mm)	IS:1060 Pt.I	Cured and uncured	0.7 ± .05
2.	Basis weight (gm/sq.m)	-do-	-do-	185 ± 5%
3.	Corrugation depth(mm)	Optical micrometer	Cured	0.25 (min.)
4.	Tensile strength (dry) (kg/cm.) A)Machine direction B)Across Machine direction	IS:1060 Pt.I	Cured	4.0 (min.) 3.0 (min.)
5.	Burst Strength (kg/cm.sq.)	-do-	Cured	2.5 (min)
6.	Mean pore size(micron)	As per AAR Bubble point test method/ASTM F-316/1986	Cured	20 ± 2
7.	Max. pore size (micron)	-do	Cured	80

4.1.2 Along with the test results specified in clause 4.1.1, the filter manufacturer shall declare the name of paper manufacturer and the identification code or grade or other markings used by the paper manufacturer to designate the particular filter paper. In case, the resin treatment on paper is done by other than the paper manufacturer, the particulars shall be declared in respect of both the base paper and the resin-treated paper.

4.1.3 Once a particular filter is type tested and approved. No change shall be made in the filter paper used. Any change, either in the base paper or its treatment, shall call for a fresh approval.

4.2 Filter Element

On preliminary acceptance of the filter paper by RDSO filter elements made out from the paper offered shall be subjected to type testing as indicated below:-

4.2.1 Physical and dimensional checks.

4.2.2 Following tests on two elements in the given sequence-

Ist filter element

- End Load Test (Clause 3.2)
- Fabrication Integrity Test (Clause 3.1)
- High Temperature Test (Clause 3.3)

2nd Filter element

- End Load Test (Clause 3.2)
- Pressure Drop Vs. Flow Rate Test (Clause 3.4)
- Filtering Efficiency and Rig life test (clause 3.5)
- Test for ability to withstand high pressure differential (Clause 3.6)
- End Load Test (Clause 3.2)
- Fabrication Integrity Test (Clause 3.1)

- 4.2.3 All the above tests shall be carried out at the same approved laboratory.
- 4.3 On results of above tests being found acceptable, filter elements shall be subjected to field service trials as per test scheme issued by RDSO on one or more locomotives to determine their performance, including service life.
- 4.4 One of the filters offered for testing on test rig and or field 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 in clause 4.1.1.
- 4.5 On satisfactory completion of all the above 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 resin impregnated filter paper, identical in all respects relating to the base paper as well as process of resin impregnation, to that used on the filter sample offered for approval.

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 resin treatment is done by other than the paper manufacturer, the certificate shall be in respect of both the base paper and treated paper. If required, documents shall be made available for examination by Purchaser/Inspector to establish the source and grade of base paper and its impregnation to enable the certificate being verified.
- 5.2 The paper used in the manufacture of filters shall be treated for properties listed in clause 4.1.1 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. For this purpose, paper sample shall be taken from the filter samples drawn from a lot for inspection. The testing of the filter paper shall be carried out at any approved laboratory agreed between the Inspector/Purchaser and supplier at the rate of at least 1 in 1000 filters or one filter per lot in case the order lot is of less than 1000.
- 5.3 The filter elements offered for supply shall be subjected to 1% check in respect of the various physical requirements of clause 2 of this specification.
- 5.4 A minimum 1 in 200 filters subject to at least one per lot of supply, shall be subjected to tests listed in clause 3.1 and 3.2 at the manufacturer's premises in presence of the inspector.
- 5.5 The filter samples for check and testing shall be selected by the inspector at random from the lot offered for inspection.
- 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 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, draw samples and to reject any material that does not conform to this specification.

6. MARKING

Name of the manufacturer, batch number, month and year of manufacture shall be embossed on the end caps as indicated in the drawing No. SKDP-3374.

7. PACKING

- 7.1 Each filter shall be packed in a water-proof poly-bag and then placed in a carton made of 3-ply corrugated paper board. These cartons shall be further packed in a wooden/5-ply corrugated paper board crates to avoid damage during transit.
- 7.2 The carton containing individual filters shall indicate manufacturers name and trade mark, batch number, month and year of manufacture and serial number of filter.

8. WARRANTY

The supplier shall undertake to replace all filters belonging to a particular batch, if defective material or manufacturing technique has been employed during manufacture. The supplier shall furnish a warranty that if the service life obtained on the locomotives is less than 92 days all filter elements belonging to the particular batch will be replaced by him free of cost unless he is able to prove conclusively that it has taken place due to reasons beyond his control.

Annexure-I

LIQUID FLOW RESISTANCE TEST

1. Purpose:

To determine the resistance of filter material to laminar flow of liquids.

2. Principle:

A test piece is clamped on the base of a tube. A known volume of liquid of known viscosity is allowed to flow through the test piece under specified gravity head. The time for this

volume to pass is recorded. The flow resistance of the material is expressed in terms of time recorded during the test.

3. Equipment:

- 3.1 Resistance tube with filter disc holder and instant release closure flap as shown in drg. No.SKDP-2296.

Levels 'X' and 'Y' are marked on the tube such that the volume from 'X' to 'Y' is equal to one litre. The head from filter disc to mark 'Y' is kept as shown in drg. No.SKDP-2296 at 216 mm.

- 3.2 Stop watch, accuracy 0.25 seconds.
- 3.3 Suitable pouring and collecting flasks.
- 3.4 Punch to cut circular test pieces 155 mm in dia.
- 3.5 Thermometer with least count 0.2 deg. c.

4. Test Liquid:

- 4.1 Test liquid is prepared by mixing HSD oil and Kerosene in suitable proportion so that at the ambient temperature at the time of test the viscosity of the liquid is 3 ± 0.1 cst. The viscosity shall be tested just before conducting the flow resistance test and shall be reported
- 4.2 The test oil shall be filtered through a 0.5 micron membrane or equivalent laboratory filter before each test.

5. Procedure:

- 5.1 Set up the tube vertically, away from draughts and other possible causes of rapid change in ambient temperature as any variations in air temperatures will affect the viscosity of test liquid.
- 5.2 Place the container of test liquid at the test location and record its temperature to the nearest 0.2 deg.c both before and after each group of 4 tests. It may be necessary to allow the liquid to stand before testing is started until its temperature is the same as the ambient temperature.
- 5.3 Cut 4 discs of 155 mm diameter from filter paper sample to be tested. Immerse the discs in the test liquid under a vacuum of at least 700 mm of mercury for at least 5 minutes and then for another 5 minutes at atmospheric pressure.
- 5.4 Insert a disc between the tube clamping surface and tighten.

- 5.5 Close the bottom flap and fill the tube with test liquid about 50 mm above the upper mark 'X' on the tube. Wait for 5 minutes and check that there is no leakage of test liquid at any part of the apparatus.
- 5.6 Open the flap valve and clock the time required for the liquid level to pass from mark 'X' to 'Y' by means of the stop watch.
- 5.7 Repeat the test on the other 3 filter paper discs.

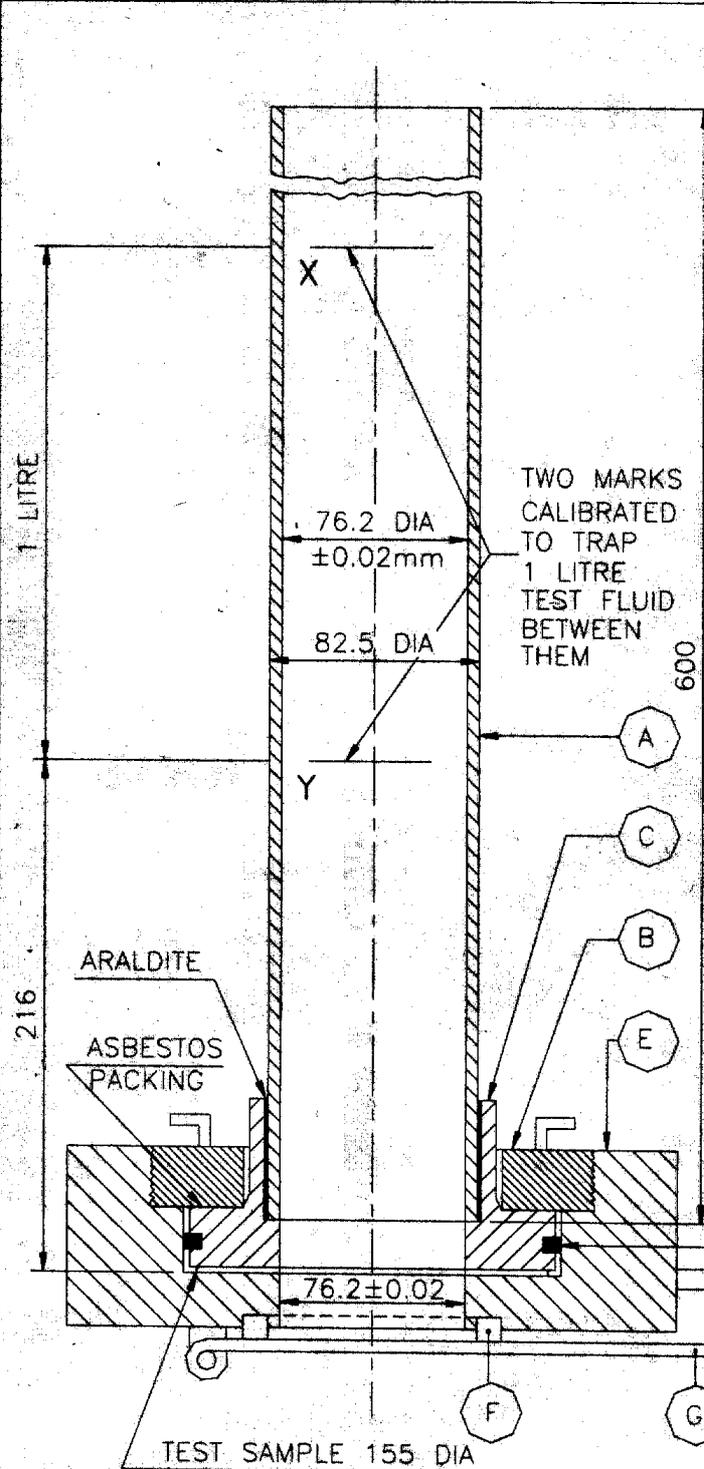
6. Reporting of test results:

- 6.1 Report the flow resistance of filter material as number of seconds, by obtaining arithmetic average of the results on four discs. The result is to be reported to the nearest 0.5 second.
- 6.2 Also indicate in the report-
 - 1. Ambient temperature deg. C
 - 2. Viscosity of test fluid at the above ambient temperature. cst
 - 3. Flow resistance readings of all the four samples separately

INDIAN RLYS
RDSO(MP)

APPLICABLE FOR

APPARATUS FOR LIQUID.
FLOW RESISTANCE TEST

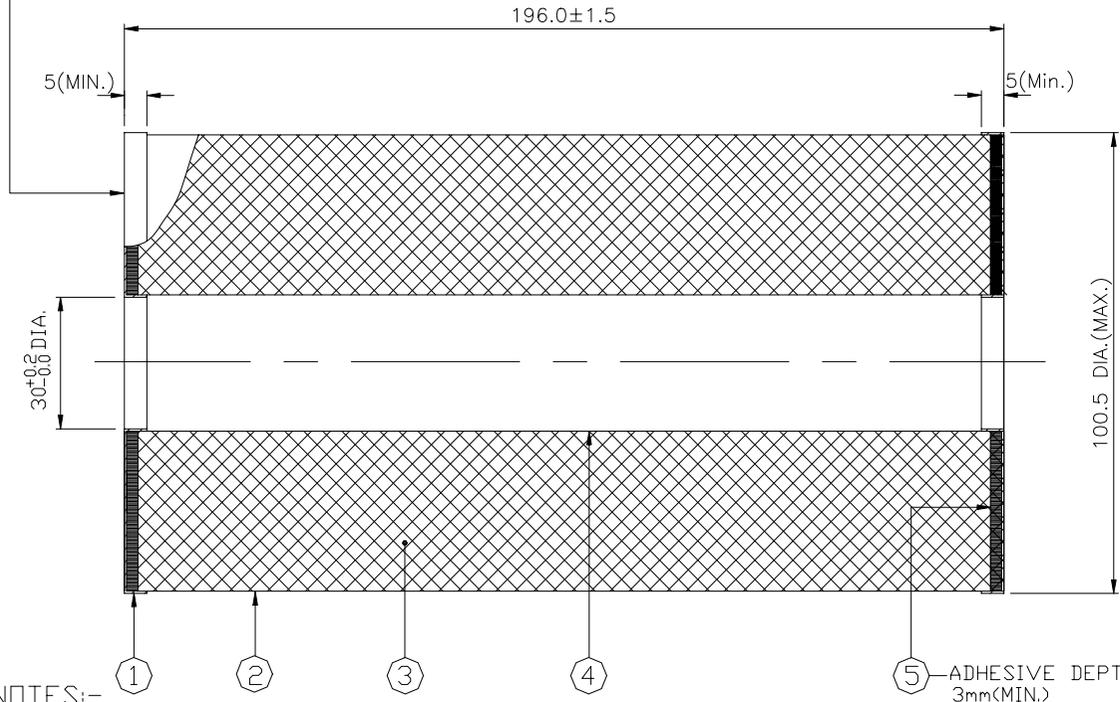


REF ITEM	DESCRIPTION
A	LUCITE OR GLASS TUBE
B	SPECIAL NUT
C	TUBE HOLDER
D	O-RING
E	BASE
F	RUBBER WASHER
G	FLAP DOOR

D	
T	
C	
TC	
APPED	
Dt	

				SCALE	REF: SK.DP-1048
RETRACED				L3-206	20.7.87
ALT:	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.	SIGN: DATE
					FIRST ISSUED
				DRG. SK.DP-2296 NO.	SUPERSEDES
					SUPERSEDED BY

INDICATE AT THIS LOCATION
MANUFACTURER'S TRADE NAME
BATCH NO. & DATE/YEAR OF
MANUFACTURE.



NOTES:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS:2102(COARSE)
3. ALL METALLIC COMPONENTS SHALL BE GALVANIZED OR TIN/ZINC/CADMIUM PLATED.
4. STEEL SHEET TO IS:513(1986) USED FOR ITEM '1' & '4' SHALL BE MINIMUM 0.4mm THICK WITHOUT PLATING. SHEET FOR ITEM '4' SHALL BE OF TEMPER 2 (HALF HARD)
5. THE HIGH DENSITY PAPER FOR OUTER WRAPPER SHALL HAVE BURSTING STRENGTH OF 3.5 Kg/cm² (minimum)
6. THIS FILTER ELEMENT IS SUITABLE FOR FILTER HOUSING TO R.D.S.O. DRG. NO. SK.DP-2592.
7. THE PARTICULARS OF PAPER MEDIA SHALL BE AS UNDER:

- (I) BASIS WEIGHT(CURED).....185 ±5%gsm
- (II) MEAN PORE SIZE.....20 ±2 MICRON
- (III) NO. OF PLEATS.....45 ±1

5	ADHESIVE	-	-	-		
4	CENTRE TUBE	1		STEEL IS:513-D		
3	PLEATED PAPER MEDIA	1		SEE NOTE-7		
2	OUTER WRAPPER	1		SEE NOTE-5		
1	END CAP	2		STEEL IS:513-D		
REF NO	I R PART NO	DESCRIPTION	NO OFF	WT(KG) EACH	MATL	SPEC

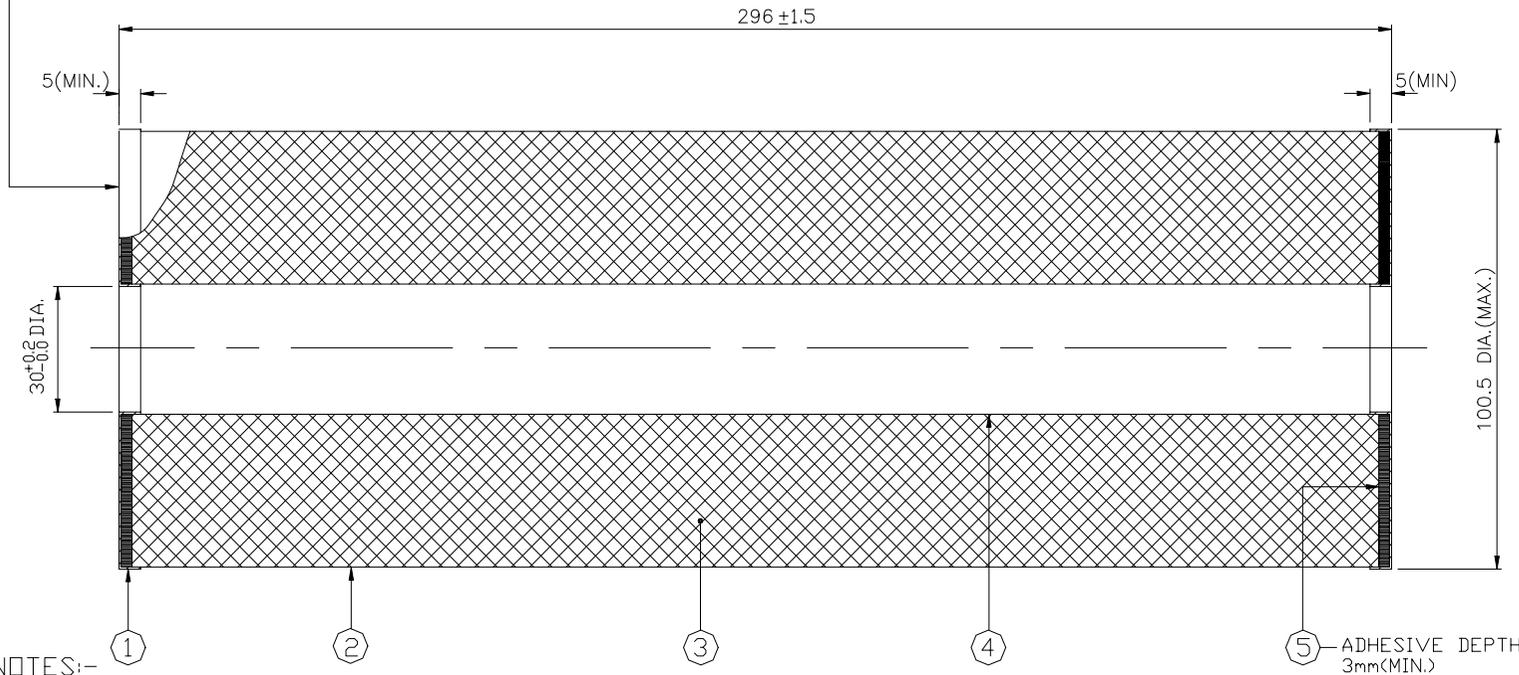
APPLICABLE FOR ALCO/DLW DIESEL LOCO.	TURBO LUBE OIL FILTER ELEMENT	
SCALE 1:1	REF:	FIRST ISSUED
INDIAN RLYS RDSO (MP)	DRG. NO. SK.DP-2694	SUPERSEDES SUPERSEDED BY

D
T
C
TC
APPD
Dt

	50	
	25	
	6.3	
	0.8	*SURFACE ROUGHNESS TO IS:3073
	0.1	WELDING SYMBOLS TO IS:813
SYMBOL	Round (MAX)	TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS: 2102 (COARSE)

ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.	SIGN	DATE
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INDICATE AT THIS LOCATION
MANUFACTURER'S TRADE NAME
BATCH NO. & DATE/YEAR OF
MANUFACTURE.



NOTES:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS:2102<COARSE>
3. ALL METALLIC COMPONENTS SHALL BE GALVANIZED OR TIN/ZINC/ CADMIUM PLATED.
4. STEEL SHEET TO IS:513(1986) USED FOR ITEM ' 1 ' & ' 4 ' SHALL BE MINIMUM 0.4mm THICK WITHOUT PLATING. SHEET FOR ITEM ' 4 ' SHALL BE OF TEMPER 2 (HALF HARD)
5. THE HIGH DENSITY PAPER FOR OUTER WRAPPER SHALL HAVE BURSTING STRENGTH OF 3.5 Kg/cm² (minimum)
6. THIS FILTER ELEMENT IS SUITABLE FOR FILTER HOUSING WITH LONGER BOWL AND CENTRE BOLT.
- ⑦ 7. THE PARTICULARS OF PAPER MEDIA SHALL BE AS UNDER:

- (I) BASIS WEIGHT< CURED>.....185 ±5%gsm
- (II) MEAN PORE SIZE.....20 ±2 MICRON
- (III) NO. OF PLEATS.....56 ±1

D	
T	
C	
Tc	
APPD	
Dt	

	50	
	25	
	6.3	
	0.8	*SURFACE ROUGHNESS TO IS:3073
	0.1	WELDING SYMBOLS TO IS:813
SYMBOL	Ra:um (MAX)	TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS: 2102 <COARSE>

①	2	AREA DELETED & NO. OF PLEAT INCREASED BY 1	L3-520	8/2/00		
ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.	SIGN	DATE

5		ADHESIVE	-	-	-
4		CENTRE TUBE	1		STEEL IS:513-0
3		PLEATED PAPER MEDIA	1		SEE NOTE-7
2		OUTER WRAPPER	1		SEE NOTE-5
1		END CAP	2		STEEL IS:513-D
REF NO	I R PART NO	DESCRIPTION	NO OFF	WT(kg) EACH	MATL SPEC

APPLICABLE FOR ALCO/DLW DIESEL LOCO. **LONG LIFE TURBO LUBE OIL FILTER ELEMENT**

SCALE	1:1	REF:		FIRST ISSUED
INDIAN RLYS	DRG. NO.	SK.DP-3374		SUPERSEDES SUPERSEDED BY