

REVISION OF SPECIFICATION / STR

Ref:Current Spec. No. C-K607 (Rev-2) Amendment-1, STR for Densified Thermal Bonded Polyester Blocks for use In Railway Coaches for Seats and Berths.

1. RDSO is reviewing the specification/STR to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
2. It is requested that your comments / suggestions with regard to improvements / modifications in specification / STR of this item may be submitted in the following format alongwith the justification for the changes required.

Part A: Basic Information

SN	Particulars	Information
1	Name	
2	Designation	
3	Professional Qualification	
4	Organization / Firm's Name	
5	Address for Correspondence	
6	Contact No.	
7	Email ID	
8	<u>In case of Firm / Individual:</u> Manufacturing experience of item (or similar Item) on which comments are offered	
9	<u>Where relevant:</u> Whether any technical document to support suggested changes is available / enclosed for better appreciation	

Part B: Comments / suggestions on the specification

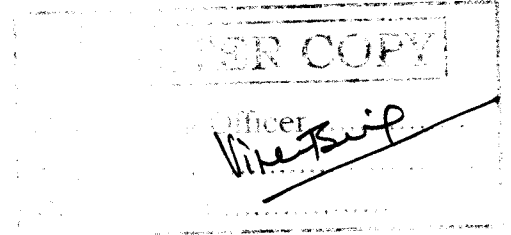
SN	Clause No. of RDSO STR / Spec	Clause, as exists in RDSO STR / Spec	Clause , as it should read after incorporation of comments / suggestions in the RDSO Spec / STR	Justification for changes

Comments may be sent to:

Director/SS/Carriage
Research Designs and Standards Organization
Manak Nagar, Lucknow – 226011

Email: edcar.rdso@gmail.com Or dirssrdso@gmail.com

INDIAN RAILWAYS



**SCHEDULE OF TECHNICAL REQUIREMENTS
FOR
DENSIFIED THERMAL BONDED POLYESTER BLOCKS
FOR USE IN RAILWAY COACHES
FOR SEATS AND BERTHS**

S. No.	Month/Year of issue	Revision / Amendment	Page No.	Reason for Amendment
1	April, 2006	-	-	First issue
2	September, 2009	Amend.-1	4 & 6	Table 3.1 (a) and warranty clause added
3	January, 2010	Amend.-2	4 & 6	Fire properties made acceptance tests
4	June, 2011	Revision – 1	3, 4, 5, 6, 7 & 8	Properties of 80 Kg/m ³ Density added. Infrastructure requirements for automated process added.
5	December, 2015	Revision – 2	All pages	Quality parameters for raw material added. Amendments/corrigendum incorporated.
6	August, 2016	Amendment-1	3	To include ISO Document No: QO-D-7.1-11 as clause 0.2 under Clause 0.0 Scope

Issued By:
Carriage Directorate
Research Designs and Standards Organisation
(Ministry of Railways)
Manak Nagar, Lucknow - 226 011

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Amendments slip No. 1 of August, 2016 to Spec No. C-K607 (Rev.-2) for Schedule of Technical requirements for Densified Thermal Bonded Polyester Blocks for use in Railway coaches for seats and berths.

In clause 0.0 **Scope, Clause 0.2** added and shall be read as under:

'All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (titled "**Vendor – Changes in approved status**") and subsequent versions/amendments 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.'

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

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Ref: CG-WI-4.2.4 (Ver -1)	Page 3 of 15	Date of Issue: Dec- 2015	Spec No. C-K607 (Rev.-2)
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SCHEDULE OF TECHNICAL REQUIREMENTS FOR DENSIFIED THERMAL BONDED POLYESTER BLOCKS FOR USE IN RAILWAY COACHES FOR SEATS AND BERTHS

0.0 SCOPE

0.1 This specification is for Densified Thermal Bonded Polyester Blocks for coach seats and berths consists of two parts i.e. Section – A and Section – B.

- **Section – A:** It covers the description, technical requirements, and method of sampling and acceptance criteria of the material.
- **Section – B:** It covers the infrastructural requirements for manufacture, testing and quality control of the product.

SECTION - A

1.0 DESCRIPTION OF THE PRODUCT

1.1 Densified thermal bonded polyester blocks are produced by converters authorized by primary manufacturer of fibre. Converters will be approved and certified by RDSO or any other Railway entity authorized by the Ministry of Railways. The blocks are made using a virgin (The virgin fibre certificate along with WTC will be given by the OEM for each lot of supply) mixture of 15 ± 1 Denier hollow polyester staple fibre with a hollow area of $18\% \pm 2$ and Low Melt Polyester Fibre, which is processed on suitable machines as per clause 1.1.1 of section-B, to get the desired bonding and densification. Bonding of the fibre mass to be achieved exclusively by the use of low melt polyester fibre as mentioned above and not by means of other chemicals/resins.

2.0 GENERAL REQUIREMENTS

2.1 Colour

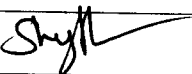


2.1.1 Unless otherwise specified, the product will be generally white in colour. However, other colours may be permitted with RDSO's approval.

2.2 Bonding

2.2.1 The product should be having good and uniform bonding throughout and should not be susceptible to tearing/delamination/sagging during handling.

2.3 Ease of handling

2.3.1 The product shall be user friendly and shall not cause any itches or skin irritation during handling.

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2.4 Dimensions & Tolerances

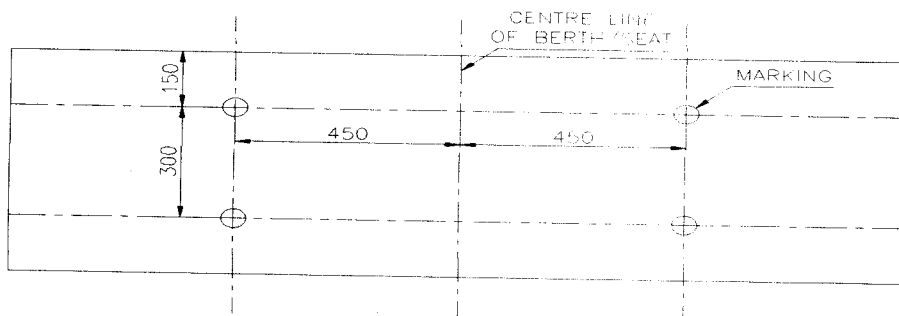
2.4.1 The product is to be supplied strictly as per the relevant drawing or as specified by the purchaser. If tolerances are not given in drawing the latest version of IS: 11060-1984 at Para 5 will be followed.

2.5 Marking & Packing

2.5.1 Each piece along the length shall be legibly marked on the front side by hot stamping or indelible ink with the following details:

- i) Name of the manufacturer/ initials/trademark, if any.
- ii) Date/Month/Year of manufacture.
- iii) Batch number.

The location of above marking should be as per the figure given below,



The material shall be suitably packed by biodegradable or recyclable material, to avoid damage/distortion during transit.

Seat & berth manufacturer should include the vendor code of Densified Thermal Bonded Polyester Blocks (DTBPB) converter on the seat/berth identification plate.

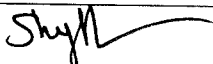


3.0 TECHNICAL REQUIREMENTS

3.1 The product shall comply with the following requirements.

S. No.	Properties	Method of test	Specified value		
1	Density (Kg/m ³)	IS: 7888 Cl. 4	50 ± 3	60 ± 3	80 ± 3
2	Tensile Strength (Kg/cm ²)	IS: 7888 Cl. 5	Min. 2.5	Min. 4.0	Min. 4.0

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3	Elongation at break (%)	IS: 7888 Cl. 5	Min. 110	Min. 110	Min. 110
4	Load Quotient	IS: 7888 Cl. 6	Min. 3:1	Min. 4:1	Min. 5:1
5	Indentation Hardness Index (Kgf)	IS: 7888 Cl 6.3.3	@ 25% 13-22 @ 40% 27-35	@ 25% 21-30 @ 40% 46-56	@ 25% 37-48 @ 40% 85-95
6	Compression set – 50% At room temp. (27°C ± 2°C) for 70 hrs.	IS: 7888 Cl. 8	Max 10%	Max 10%	Max 10%
7	Humidity Ageing (%) Hardness loss	ISO: 2440	Max 15	Max 13	Max 13
8	Durability or Fatigue test				
	a Loss in Indentation Hardness at Constant load* (%)	IS: 7888 Cl. 7.3.2	Max 30	Max 26	Max 26
	b Loss in Thickness (%)		Max 12	Max 10	Max 4
9	Tear Strength (Kg/cm)	ISO: 8067	Min. 1.0	Min. 1.5	Min. 2.5
10	Resilience (%)	ISO: 8307	Min. 50	Min. 45	Min. 35
11	Delamination Test (Parallel)	ISO: 8067	Min. 2.5 N/2.5cm	Min. 2.5 N/2.5cm	Min. 2.5 N/2.5cm
12	Resistance to spread of flame	Appendix – 8 of UIC 564-2 OR	Min. Class - B	Min. Class - B	Min. Class – B
13	Deterioration of visibility due to smoke	Appendix – 15 of UIC – 564-2 OR	Class – A	Class – A	Class – A
14	Limiting Oxygen Index	IS: 13501	Min. 30	Min. 30	Min. 30
15	Toxicity	NCD: 1409	Less than 1	Less than 1	Less than 1
16.	Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m ²) as specified in EN 45545-2:2013	ISO 5660-1: 25 KW/m ²	R21 (HL3)	R21(HL3)	R21(HL3)

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* - Load required to compress the sample to 40% of its original thickness.

Note: The average density for 50kg densified thermal bonded polyester block will remain as $50 \pm 3 \text{ kg/m}^3$ but individual value will not be less than 45 kg/m^3 or more than 55 kg/m^3 .

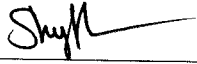


The average density for 60kg densified thermal bonded polyester block will remain as $60 \pm 3 \text{ kg/m}^3$ but individual value will not be less than 55 kg/m^3 or more than 65 kg/m^3 .

The average density for 80kg densified thermal bonded polyester block will remain as $80 \pm 5 \text{ kg/m}^3$ but individual value will not be less than 75 kg/m^3 or more than 85 kg/m^3 .

3.2 Applicability of different densities of densified thermal bonded polyester block for different types of coaches:

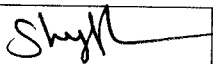


Type of Coaches	Lower Berth/Seat	Middle Berth	Upper Berth	Back Rest
FAC & 2AC Coaches	60 kg/m^3	-	60 kg/m^3	60 kg/m^3
3AC Coaches	60 kg/m^3	60 kg/m^3	60 kg/m^3	-
SCN Coaches	60 kg/m^3	60 kg/m^3	60 kg/m^3	-
GS Coaches	80 kg/m^3	-	-	60 g/m^3

* 50 kg/m^3 density shall be used only for softer applications with prior approval of RDSO.

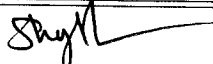


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3.3 The polyester fibre used to make Densified Thermal Bonded Polyester Blocks should comply with the following test:

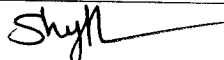


S. No	Test	Principle	Proposed Norms		Test Instrument required	Test procedure in brief
			For the base fibre of 15 Denier	For Low Melt Fibre		
1	Isophthalic Acid (IPA) content	Presence of IPA indicates that the fibre is produced through recycled route and is not virgin.	Nil	N/A	Chemical analysis through Gas chromatography	The polymer sample is digested in benzyl alcohol, depolymerized then esterified to dibenzyl isophthalate, dibenzyl terephthalate and glycol's. Isopropyl titanate is added as a depolymerisation catalyst. The sample is analysed by gas chromatography and the peak areas of the two esters are used to estimate the weight percentage of dimethyl isophthalate.
2	Detection of pre-blended mixture of 15 den hollow polyester fibre and low melt polyester fibre	From the difference in fluorescence in UV lamp the presence of low melt fibre is ascertained	Gives bright fluorescence	Gives a faint violet shade	Cabinet with UV glow	About 10 grams of fibre is collected randomly from the bale and spread under UV light in a UV cabinet, preferably in a thin lap form.. After sometime observe the sample for glow. The low melt fibre gives a faint violet shade while 15 Denier Hollow Polyester Fibre gives a bright fluorescence.
3	Fineness (Denier)	Linear density measurement of the fibre- Weight in grams per 9000 m	15 ± 1	4.7 (Max.)	Vibromat ME	Test Standard: ASTM D 1577. The linear density, mass per unit length of a single fibre is calculated on the instrument from the fundamental resonant frequency of transverse vibration measured under known conditions of length and tension. A single fibre is taken from the tuft, gripping one end of the fibre by pre-tensioning weight

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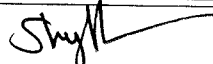


						(equivalent to 50 mg/den) and the other end is inserted in the clamp of the instrument , the fibre hangs upside down along with the pre-tension weight. Ensure that the fibre is not oscillating much. Now press the measurement key. The instrument will automatically display the denier on the screen along with the frequency curve. Average value of 25 number of test specimen readings is recorded.
4	Tenacity	Tensile strength of the fibre-grams per denier	3.4±0.5	3.5 ± 0.7	Fafegraph HR	Test Standard ASTM D 3822. Single fibre specimen of known denier are broken on a constant-rate - of extension type tensile testing instrument at a predetermined gauge length and rate of extension. Breaking load divided by denier is tenacity expressed in gram/den (gpd). Average value of 25 number of test specimen readings are recorded.
5	Crimps / per cm	No. of arcs or crimps per unit length i.e. cm of the fibre specimen which is having a sine wave configuration	2 ±0.4	2.6 ± 0.5	Crimp Balance	The test sample is kept spread on the table. Fibre clusters are picked up at random from different places ensuring proper representation of the sample. Set the test length to 20mm on crimp balance and attach the crimp removal load (50mg/den) on the left side arm of the crimp balance. Pick up one fibre specimen from each fibre tuft using forceps. Place this specimen on a specimen board and using fingertip pressure, flatten each specimen with the crimps in a plane parallel to the board taking care that the crimps are not

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						<p>disturbed. To the one end of test specimen attach a paper gum tag (very light weight just to hold the fibre). Grip the free end of the specimen with tweezer and clamp one end in the upper clamp and other end in lower clamps.(end where paper gum tag is attached).Count the number of peaks, against the contrasting background with vertical line. Record the number of peaks. Use magnifying glass (a low magnification not more than 10 X) with illumination for counting. Lower the lower clamp at a traverse speed of 0.5mm to 1mm /sec till the crimp removal load is balanced so that the fibre is just straightened without any deformation. On releasing the load, crimps are recovered partly on the fibre confirming that the fibre is not stretched. Record the reading on the micrometer scale correct to 0.01mm. Divide the number of peaks by 2 to get the number of crimps. Use the values in the formula to calculate the crimp frequency or crimps/cm on actual straightened length of fibre. Likewise, 20 nos. fibres are analysed and average be taken. Calculation : Crimps / cm = (No of peaks counted x 10) / (Testing length mm x 2)</p>
6	% Finish	% OPU (oil pick up) of finish applied on the fibre for smooth	0.18 ± 0.04	0.12 ± 0.04	Rapid OIL extractor	Finish oil applied on a known mass (2 gm) of fibre is extracted using Methanol as a solvent, the oil and solvent mixture is squeezed on to an aluminium pan kept on a heater (maintained at

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		running in downstream application				controlled temperature) ensuring 100% extraction. In the second step the solvent is evaporated leaving only the oil part as residue. From the fibre mass and the oil mass, percentage application is calculated precisely to three decimal places. Calculation : ((Wt. of dry pan + residue) - Wt of empty pan) x 100/ Wt of fibre sample
7	% DHS (Dry Heat Shrinkage) at 196 Deg. C x 30min	Measurement of the shrinkage of single fibre when exposed to hot air	Max. 3.5	NA	Single Fibre Shrinkage Testing apparatus	Ten fibres are taken out at random from the sample to be tested and kept on the specimen board. Without stretching, one end of each fibre specimen is gripped with a pretension weight (just sufficient to straighten the fibre).The other end of fibre is held with forceps and mounted on the fibre clamping device of the shrinkage testing apparatus. Initial length of the specimen is measured using the vertical Vernier scale mounted on the side of the apparatus by sliding and coinciding the eye piece to both ends of the fibre specimen. Take initial length reading of the all the ten specimens. Take out the sample holder cylinder from position and in relaxed state put the sample holder in hot air oven maintained at 196 +/-2 deg. C for 30 minutes take out the sample holder and cool in lab atmosphere for another 30min. Measure final length (length after shrinkage). The % change in length between the initial and after heat treatment/oven conditioning gives %DHS. Avg. of 10 fibre readings

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						is recorded.
8	% Hollowness	Ratio of the area of the inner hole of the hollow fibre to the total cross-sectional area of the fibre	18 ± 2	NA	Microscope (with software program for cross sectional area measurement)	Prepare a microscopic cross-section slide of a bunch of fibre. Put the slide under microscope and focus the specimen with proper magnification. Select a single fibre cross section and select the inner hole area. Then run the software program for determining the area. Similarly select the total area and calculate the total area. The ratio is converted to % age to find the hollowness (%). Then finally average value of 15-20 fibres at random is recorded.

The raw material will be accepted on Work Test Certificate (WTC) of OEMs. If the converter is procuring hollow polyester staple fibre and low melt polyester fibre separately, the converter will test as per table above in clause 3.3 at S. No. 2. The WTC of this test shall be kept as record by converter. The converter will maintain records of the WTCs for each lot and shall present them for inspection whenever required.

4.0 SAMPLING & CRITERIA FOR CONFORMITY

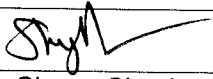


The sampling test shall constitute type tests and acceptance tests.

4.1 Type tests

4.1.1 The test for durability or fatigue test is type test and shall be done once in each quarter

The test for Heat release rate (HRR) is type test till 31.03.2015. Heat release rate (HRR) test is to be done at every six months till 31.03.2016. Thereafter it will be part of acceptance test. However, RDSO may draw the sample at its discretion as and when required and send the same for testing.

A representative of Railways shall draw a sample once at a time interval mentioned above and firm shall arrange testing at a reputed laboratory as decided between Railways and the manufacturer. The testing charges shall be borne by the manufacturer.

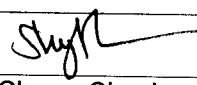
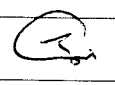
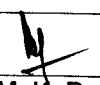
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4.2 Acceptance tests

- 4.2.1 All the tests under clauses 3.1 except durability or fatigue test shall constitute acceptance tests along with two additional criteria viz. visual observation and dimensional check and shall be carried out on each lot.
- 4.2.2 The lot size shall constitute a maximum of 500 Nos. of seats/berths/upper berths etc.
- 4.2.3 The number of pieces to be selected from the lot for acceptance test shall be as under:
- | | |
|--|--|
| Visual observation | : 100% of the lot. |
| Dimensional check | : 5% of the lot or 10 samples whichever is more. |
| For remaining test
i.e. acceptance tests. | : Three samples or as per test method specified |
| For type tests | : Scale of Sample should be as per test method Specified |
- 4.2.4 Each of the test samples undertaken for the tests shall conform to the requirements as laid down in Clauses 3.1. If the samples fail to meet the requirements, double the number of original samples shall be drawn for the tests. If any of the retest samples fail to meet the requirements, the entire lot shall be rejected and scraped in the presence of inspecting authority.
- 4.2.5 In case of non-compliance in regard to dimensional check, the manufacturer may be given one chance to segregate the lot for dimensional conformity.
- 4.2.6 The manner of distribution of the test samples for different tests prescribed shall be at the discretion of inspecting officer/purchaser.

5.0 WARRANTY

The store supplied against an order shall be deemed to bear a warranty of the manufacturer against defective materials/workmanship and performance for a period of 30 months from the date of supply or 24 months of fitment of seats/berths whichever is earlier. The products shall be warranted against de-bonding/de-lamination of the material during service. The sagging/reduction in thickness of seats and berths shall be less than 10% of original thickness. In case the material shows any defects/fails within warranty period, it shall be replaced by a new one without any cost within one month of receipt of information. The warranty for such material shall be 24 months from the date of replacement.

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SECTION B

INFRASTRUCTURAL REQUIREMENTS FOR MANUFACTURE, TESTING AND QUALITY CONTROL:

1.0 The manufacturer of densified thermal bonded polyester blocks shall comply with the following requirements:

1.1 INFRASTRUCTURE REQUIREMENTS:

1.1.1 The whole production line shall be controlled by automatic, sequentially controlled man-machine interface having digital display of vital parameter and synchronous start of whole production line. The production line should consists of following,

- a. Bale Opener
- b. Pre Opener
- c. Main Opener
- d. Vibratory Feeding machine
- e. Double Doffer carding machine
- f. Cross lapper machine
- g. Continuous Belt Oven
- h. Cooling Chamber
- i. Cutting machine.

1.1.2 Moulding Machine to produce suitable moulded parts for contoured blocks.

1.1.3 Suitable material handling System should be available with the firm.

1.1.4 Storage Space: The firm shall have adequate storage space for both finished goods and raw material.

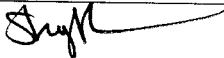


1.1.5 A weighing machine with a capacity of Min. 100 kgs and with an accuracy of 10 gms should be available.

1.1.6 Electronic weighing equipment with a capacity of 500 gms and an accuracy of 1 gm should be available.

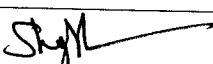


2.0 TESTING FACILITIES:

2.1 The testing lab should have facility for temperature and humidity control.

2.2 The manufacturer of Densified thermal bonded polyester blocks must have all facilities for various tests mentioned in Clause - 3.1 of section-A.

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- 2.3 RDSO may pickup sample from the supplies on its discretion. If tested outside lab testing charges will be borne by the firm.
- 3.0 QUALITY CONTROL REQUIREMENTS**
- 3.1 Vendor should possess valid ISO 9001 certificate for manufacture of DTBPPB at his works address., Further, it shall be certified by the vendor that the certifying body which issues the ISO: 9001 certificate is accredited by an accreditation body that is a part of the International Accreditation Forum (IAF) under the Multilateral Recognition Arrangement (MLA).
- 3.2 The Quality manual of the firm for ISO: 9001 should clearly indicate at every stage the control over manufacturing and testing of the said railway product.
- 3.3 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.
- 3.4 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects:
- Organisation chart
 - Process flow chart
 - Stage inspection details from raw materials stage to finish product stage
 - Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
 - Disposal system of rejected raw material and components.
- 3.5 There should be at least one full time technologist having a Min. Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in relevant field with experience of at least 5 years or a person with Diploma in relevant field with 12 years experience. He should be free from day-to-day production, testing and quality control responsibilities. He should be mainly responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.
- 3.6 Ensure that the incharge of the Quality Control Section is having a qualification of Min. Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in the relevant field with a Min. of 5 years experience or alternatively he should be a Diploma holder with Min. of 12 years experience. He should be actively involved in day-to-day activities of quality control / stage inspection / compliance of QAP etc.
- 3.7 The firm must ensure that proper analysis is being done on monthly basis to study the rejections at various internal stages and it is documented.
- 3.8 The firm should ensure that latest version of all the relevant specifications, IS standards are available with the firm.

Signature			
Name & Designation	Prepared By: Shyam Shankar JE/SS/Carriage	Checked By: Tarkeshwar Singh SSE/SS/Carriage	Approved By: M. K. Pandey Director/SS/Carriage

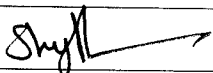


4.0 DOCUMENTATION

Firm shall maintain following documents/records:

- 4.1 A well-documented Quality Plan.
- 4.2 Incoming raw material register with Test Certificates references of suppliers and internal test results.
- 4.3 Stage inspection results including finished products results.
- 4.4 Records of internal rejection and its analysis vis-a-vis action plan.
- 4.5 Records of final products inspection by external agencies (like RDSO), Non – Conformity reports and case analysis as well as action taken thereof.
- 4.6 Records for maintenance of dies/moulds.
- 4.7 Ensure that proper systems are available for dealing with customer complaint.

5.0 TRAINING

- 5.1 Training needs should be identified for all concerned officials and regular training shall be organised and imparted on maintenance of machines, quality assurance, safety parameters etc.

Signature			
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