Annexure-I

REASONED DOCUMENT ON COMMENTS/SUGGESTIONS RECEIVED ON DRAFT OF SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE OF PSC SLEEPER DOCUMENT NO. TDG-0046

<table>
<tr><th>Para NO.</th><th>SN</th><th>Proposed/Modified Para/Clause of STR for 30 days</th><th>Comments/Suggestions received from stakeholders</th><th>RDSO's Remarks</th><th>Final Proposed/Modified Para/Clause of STR for 15 days</th></tr>
<tr><td>Name of STR</td><td></td><td>Schedule of Technical Requirements (2025) for manufacture of PSC sleepers</td><td>No comments recieved</td><td>No change</td><td>Schedule of Technical Requirements (2025) for manufacture of PSC sleepers</td></tr>
<tr><td></td><td></td><td>DOCUMENT NO TDG 0046 APRIL 2025</td><td>No comments recieved</td><td>No change</td><td>DOCUMENT NO TDG 0046 APRIL 2025</td></tr>
<tr><td></td><td></td><td>INDEX<table><tr><th>SN</th><th>Part</th><th>Description</th></tr><tr><td>1</td><td>Part-A</td><td>Schedule of Technical Requirements for manufacture of PSC sleepers for mainline & turnout by stress bench and long line method</td></tr><tr><td>2</td><td>Part-B</td><td>Schedule of Technical Requirements for Automatic concrete sleeper plants for manufacturing of PSC sleepers for use with modern fastening systems conforming to category “C” as per EN 13481-1:2012 and EN 13481-2:2022 for ballasted track</td></tr><tr><td>3</td><td>Part-C</td><td>Formats for maintaining records of tests conducted on various raw materials and concrete cubes & sleepers</td></tr></table></td><td>No comments recieved</td><td>No change</td><td>INDEX<table><tr><th>SN</th><th>Part</th><th>Description</th></tr><tr><td>1</td><td>Part-A</td><td>Schedule of Technical Requirements f manufacture of PSC sleepers for mainline & turnout by stress bench and long lin method</td></tr><tr><td>2</td><td>Part-B</td><td>Schedule of Technical Requirements Automatic concrete sleeper plants manufacturing of PSC sleepers for use w modern fastening systems conforming category “C” as per EN 13481-1:2012 and 13481-2:2022 for ballasted track</td></tr><tr><td>3</td><td>Part-C</td><td>Formats for maintaining records of te conducted on various raw materials a concrete cubes & sleepers</td></tr></table></td></tr>
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SCHEDULE OF TECHNICAL REQUIREMENT (2025) FOR MANUFACTURE OF PSC SLEEPER BY STRESS BENCH AND LONG LINE METHOD</td><td>No comments recieved</td><td>No change</td><td>Part-A

SCHEDULE OF TECHNICAL REQUIREMENT (2025) FOR MANUFACTURE OF PSC SLEEPER BY STRESS BENCH AND LONG LINE METHOD</td></tr>
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7.0	7.1.5	<table><tr><th>S No.</th><th>Particulars</th><th>Qty.</th></tr><tr><td>7.1.5</td><td>Replacement of Concrete sleeper Moulds to avoid in service distortion of moulds and production of defective sleepers.</td><td>After using the mould for casting of 4500 nos of sleepers **OR** after 5 years of usage whichever is earlier.</td></tr></table>	**M/s Engipress Industries Pvt Ltd, Shanichara plant, NCR.** Taking 300 working days per year, and 2 shifts per day, each year mould is used 600 times. So in 5 years, only 3000 castings are there. Therefore life should be 4500/600 = 7.5 years and not 5 years. For those running 3 shifts, it is ok to have 5 years. **M/s Rampurhat PSC Sleepers Ltd.** Mould Rotation	Normally only 2 shifts are possible in a day because of 11 to 12 hrs of steam curing of sleepers. The degradation of moulds will take place due to passage of time even if the moulds are not used to the prescribed number of times. Therefore the provision of 5 years has been considered for replacement of moulds so as to ensure dimensional accuracy of PSC sleppers. Also, distortion of moulds takes place due to bad handling during casting and demoulding of sleepers. Even warping and bending of moulds takes place due to bad casting practices. **Hence the suggestion is not accepted.** Normally only 2	<table><tr><th>S No</th><th>Particulars</th><th>Qty.</th></tr><tr><td>7.1.5</td><td>Replacement of Concrete sleeper Moulds to avoid in service distortion of moulds and production of defective sleepers.</td><td>After using the moul for casting of 4500 nos sleepers **OR** after 5 years of usage whichever is earlier.</td></tr></table>

			and Lifespan As per our manufacturing operations, each mould is typically used for approximately 2,300 castings over a period of 5 years. Therefore, to achieve a more effective utilization of the moulds, we suggest increasing the specified time period to 10 years, which will allow for up to 4,600 castings per mould. Additionally, we manufacture multiple types of sleepers, and hence, in such cases, a single mould may produce not more than 300 sleepers annually. This further supports the need for a longer operational life for the moulds to ensure cost efficiency and optimal usage.	shifts are possible in a day because of 11 to 12 hrs of steam curing of sleepers. The degradation of moulds will take place due to passage of time even if the moulds are not used to the prescribed number of times. Therefore the provision of 5 years has been considered for replacement of moulds so as to ensure dimensional accuracy of PSC sleppers. Also, distortion of moulds takes place due to bad handling during casting and demoulding of sleepers. Even warping and bending of moulds takes place due to bad casting practices. **Hence the suggestion is not accepted.**	

8.0	8.0.33	**S. N** / **Equipment** / **Quantity** 8.0.33 — Brinell Hardness Tester (BHN / HB) scale equipped with inbuilt camera for capturing image of indentation and capable of displaying image and measuring its size in fully automatic mode along with provision for displaying hardness as well. The system should have facility of storage of image and test results with details of samples. Standard test block with sufficient range should also be available. — 1 set 8.0.34 — Digital Vernier calipers 0 to 2000mm for checking gauges — 1no.	M/s Rampurhat PSC Sleepers Ltd. Brinell Hardness Tester (BHN/HB) The requirement for a Brinell Hardness Tester equipped with an inbuilt camera for capturing indentation images and fully automatic image processing and hardness display is noted. However, this equipment represents a high capital expenditure, which may not be justifiable for all manufacturing units. We suggest that such a fully equipped setup may be mandated at the supplier's manufacturing unit, while a portable or semi-automatic Brinell Hardness	Hardness of inserts plays a very crucial role in ensuring longevity of inserts. If elongation of insert takes place during service, it will create lot of maintenance problem and safety issues also. To ensure the quality of inserts before manufacturing of sleepers and to have record of hardness of inserts the provision has been added. **Hence the suggestion is not accepted.**	**S. N** / **Equipment** / **Quantity** 8.0.33 — Brinell Hardness Tester (BHN / HB) scale equipped with inbuilt camera for capturing image of indentation and capable of displaying image and measuring its size in fully automatic mode along with provision for displaying hardness as well. The system should have facility of storage of image and test results with details of samples. Standard test block with sufficient range should also be available. — 1 set 8.0.34 — Digital Vernier calipers 0 to 2000mm for checking gauges — 1 no.

			Tester may suffice at the sleeper manufacturing unit. This would enable basic testing and quality assurance without incurring significant costs, while still ensuring compliance with standards.		
		Part-B **SCHEDULE OF TECHNICAL REQUIREMENTS FOR AUTOMATIC CONCRETE SLEEPER PLANTS FOR MANUFACTURING OF PSC SLEEPERS FOR USE WITH MODERN FASTENING SYSTEMS CONFORMING TO CATEGORY "C" AS PER EN 13481-1:2012 AND EN 13481-2:2022 FOR BALLASTED TRACK**	No comments recieved	No change	**Part-B** **SCHEDULE OF TECHNICAL REQUIREMENTS FOR AUTOMATIC CONCRETE SLEEPER PLANTS FOR MANUFACTURING OF PSC SLEEPERS FOR USE WITH MODERN FASTENING SYSTEMS CONFORMING TO CATEGORY "C" AS PER EN 13481-1:2012 AND EN 13481-2:2022 FOR BALLASTED TRACK**
	1.0	*NAME OF SLEEPER PLANT:* a) Location: b) Railway: c) Nearby Railway Station: d) Nearby Main Station: e) Distance from Main & Nearby Station: f) Telephone/Fax No. g) Address: i) Office: ii) Factory: h) Details of Production: Type of sleeper/ Drawing No.	No comments recieved	No change	*NAME OF SLEEPER PLANT:* j) Location: k) Railway: l) Nearby Railway Station: m) Nearby Main Station: n) Distance from Main & Nearby Station: o) Telephone/Fax No. p) Address: i) Office: ii) Factory: q) Details of Production: Type of sleeper/ Drawing No.

<table>
<tr><td></td><td></td><td>i) Whether Plant is approved for manufacturing any other type of sleeper:</td><td></td><td></td><td>r) Whether Plant is approved for manufacturing any other type of sleeper:</td></tr>
<tr><td></td><td>2.0</td><td>METHOD OF MANUFACTURE: The method of manufacturing shall be fully automatic.</td><td>No comments recieved</td><td>No change</td><td>METHOD OF MANUFACTURE: The method of manufacturing shall be fully automatic.</td></tr>
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Typical organization structure chart of a Concrete Sleeper Plant is as given below-</td><td>No comments recieved</td><td>No change</td><td>ORGANISATION STRUCTURE

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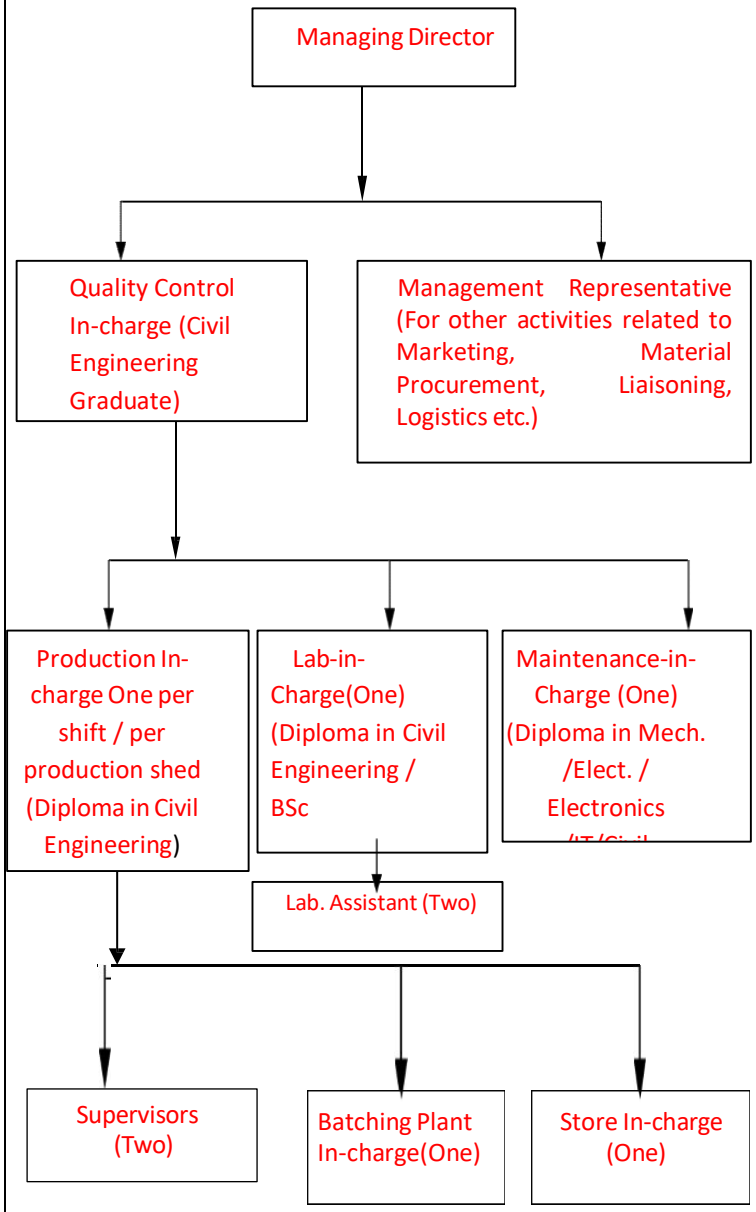
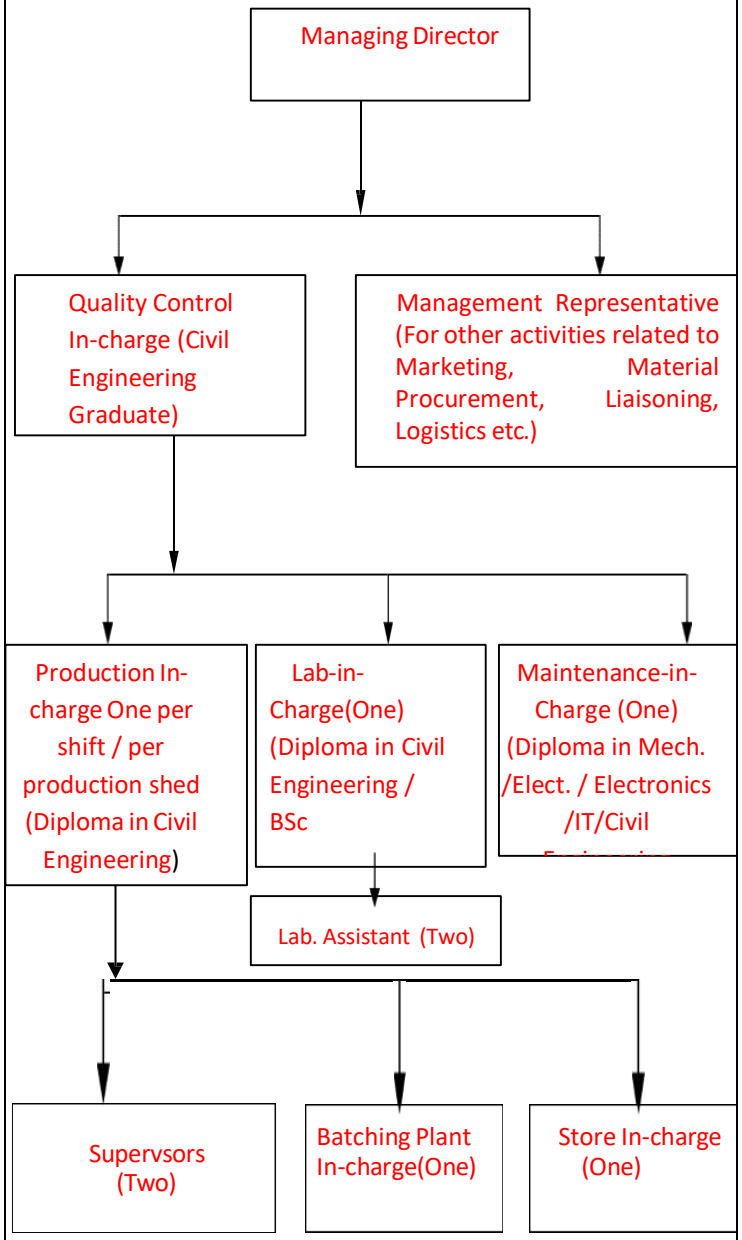

Managing Director
Quality Control In-charge (Civil Engineering Graduate)
Management Representative (For other activities related to Marketing, Material Procurement, Liaisoning, Logistics etc.)
Production In-charge One per shift / per production shed (Diploma in Civil Engineering)
Lab-in-Charge(One) (Diploma in Civil Engineering / BSc
Maintenance-in-Charge (One) (Diploma in Mech. /Elect. / Electronics
Lab. Assistant (Two)
Supervisors (Two)
Batching Plant In-charge(One)
Store In-charge (One)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Store In-charge (One)

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<tr><th>S. No.</th><th>Post/ Designation</th><th>Minimum No.</th></tr>
<tr><td>5.1.1</td><td>Overall Quality Control In-charge</td><td>At least One Graduate Engineer with Civil Engineering degree.</td></tr>
<tr><td>5.1.2</td><td>Shift In-charge</td><td>(a) Minimum one supervisor
(b) Minimum one diploma engineer of mechanical/electrical/electronic /IT /civil for maintenance</td></tr>
<tr><td>5.1.3</td><td>Quality Control Supervisor for Laboratory and testing</td><td>Minimum one supervisor with Diploma in Civil Engg./ BSc .</td></tr>
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<td>5.2</td>
<td>Details for level of supervision:

<table>
<tr><th>S No.</th><th>Item</th><th>Name</th><th>Qualification</th><th>Experience</th></tr>
<tr><td>5.2.1</td><td>Nos. of Engineers</td><td></td><td></td><td></td></tr>
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				automatic control arrangement.								automatic control arrangement.	
		6.1.5	Submerged water curing tanks, if required	Minimum Submerged water curing capacity required (In no of sleeper) = (0.65 to 0.75) *N Where, 'N' is monthly production capacity. Capacity of one tank should be maximum up to 3 days production. Tank should have minimum 30 cm free board.					6.1.5	Submerged water curing tanks, if required	Minimum Submerged water curing capacity required (In no of sleeper) = (0.65 to 0.75) *N Where, 'N' is monthly production capacity. Capacity of one tank should be maximum up to 3 days production. Tank should have minimum 30 cm free board.	
		6.1.6	Stacking Area for finished sleeper	Minimum 2 month's capacity. Maximum layers of sleepers in one stack should be 25. Minimum area=0.08*Nsqm. Where N is monthly production capacity.					6.1.6	Stacking Area for finished sleeper	Minimum 2 month's capacity. Maximum layers of sleepers in one stack should be 25. Minimum area=0.08*Nsqm. Where N is monthly production capacity.	
		6.1.7	Laboratory	General: Approximately 40 sqm Sleeper testing area: Approx 30 sqm The laboratory and sleeper testing area should be illuminated and should have 100% power backup. The laboratory shall be provided with adequate air conditioners for temperature and humidity control.					6.1.7	Laboratory	General: Approximately 40 sqm Sleeper testing area: Approx 30 sqm The laboratory and sleeper testing area should be illuminated and should have 100% power backup. The laboratory shall be provided with adequate air conditioners for temperature and humidity control.	
		6.1.8	Inspecting Officials office	Minimum 14 sqm. Fully furnished with adequate communication facilities (Fax, Telephone, Computer with net connectivity etc.)					6.1.8	Inspecting Officials office	Minimum 14 sqm. Fully furnished with adequate communication facilities (Fax, Telephone, Computer with net connectivity etc.)	
		6.1.9	Rest House	Minimum two room sets fully furnished with attached toilet and other amenities including cooking facility. Min. area 25 sqm.					6.1.9	Rest House	Minimum two room sets fully furnished with attached toilet and other amenities including cooking facility. Min. area 25 sqm.	
		6.1.10	Platform for turnout sleeper	At least two platforms of 70 mx6 m with gantry arrangement for handling for inspection of two sets at a time. (Optional, as per requirement)					6.1.10	Platform for turnout sleeper	At least two platforms of 70 mx6 m with gantry arrangement for handling for inspection of two sets at a time. (Optional, as per requirement)	

	7.0	MINIMUM PLANT AND MACHINERY: Following Plant and machinery in adequate number and of adequate capacity to match with the daily production requirement shall be mandatory for production of PSC sleepers			MINIMUM PLANT AND MACHINERY: Following Plant and machinery in adequate number and of adequate capacity to match with the daily production requirement shall be mandatory for production of PSC sleepers

S. No.	Particulars
7.1	Gang Moulds with 4 cavities for Line sleepers
7.2	Suitable Conveyors with tilting function for automatic transportation of gang moulds for various activities involved in the production of PSC sleepers to ensure automatic motion management.
7.3	i. Tilting table for cleaning ii. Automatic application of demoulding agent
7.4	Automatic machine for laying of Prestressing steel in the moulds
7.5	Automatic tensioning machine for tensioning of Prestressing steel with provision of digital display and recording of tensioning force
7.6	Automatic Batching Plant using Microprocessor based Weigh Batcher, pneumatically operated Aggregate Bins, Water meter and automatic Cement feeding. It should be capable of keeping batch wise digital record of ingredients used & data storage capability for one year production. It should be possible to print hard copies of the data.
7.7	Automatic Concrete spreader.
7.8	High Frequency Vibrator of suitable frequency to achieve proper compaction. The vibrator should have recording facility for recording date and time of each operation. RPM should be digitally displayed during operation.
7.9	Automatic machine for lifting, transporting and placing of moulds to concrete curing chamber and to de-tensioning location after curing.
7.10	Automatic de-tensioning machine with provision for simultaneous de-tensioning
7.11	Automatic lifting, turning and demoulding machine

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<tr><td>7.12</td><td>Laser based dimensional checking unit for checking of critical dimensions of PSC sleeper after demoulding, with provision for digital recording, display and processing of measured data. The system should be capable of comparing the measured data with the standard dimensions with tolerances and generating the Exception Reports.</td></tr>
<tr><td>7.13</td><td>Cranes/ Machinery of suitable capacity for lifting, transportation of sleepers and stacking etc.</td></tr>
<tr><td>7.14</td><td>Centralized Control System for the control, display and real time monitoring of complete production process with provision for generating digital records and analysis of data.</td></tr>
<tr><td>7.15</td><td>Mechanized equipment and tools specified by the fastening supplier for fixing fastenings on the sleepers.</td></tr>
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Note: Any additional plant and machinery can be deployed for enhancing automation and modernization of Concrete sleeper plant.
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<table>
<tr><th>SN</th><th>Equipment</th><th>Quantity</th></tr>
<tr><td>8.1</td><td>Compression Testing Machine, 2000 KN capacity, motorized with 2 nos. of pressure gauges (2000 KN & 500 KN) with digital interface for real time recording of testing results. The system should have sufficient memory to store data of one year production with reporting facility in hard copy as per mutually agreed format.</td><td>1 no.</td></tr>
<tr><td>8.2</td><td>Flexural Beam (Tension) Testing Machine with loading Jacks, 30 KN capacity. The machine should be capable of digital display and uneditable recording of data during testing with auto stamping of time & date of testing. Data storage & retrieval capability should before one year production.</td><td>1 no.</td></tr>
<tr><td>8.3</td><td>Motorized pumping unit with 1000 KN capacity jacks, pressure gauge, rubber tubes and test frame complete for sleeper</td><td>1 no.</td></tr>
</table>
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<td>No comments recieved</td>
<td>No change</td>
<td>
LABORATORY EQUIPMENTS:
<table>
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			testing. The digital display of the load applied should be visible to observer simultaneously along with observation of crack. The data shall be recorded in computer with automatic date and time record with Batch no. and other details for traceability of record.							testing. The digital display of the load applied should be visible to observer simultaneously along with observation of crack. The data shall be recorded in computer with automatic date and time record with Batch no. and other details for traceability of record.	
		8.4	15 cm cube moulds confirming to IS:516	50 nos.					8.4	15 cm cube moulds confirming to IS:516	50 nos.
		8.5	Beam moulds10x10x50 cm size	2nos.					8.5	Beam moulds10x10x50 cm size	2nos.
		8.6	Slump Tester/Vee Bee Testing Machine	1 no.					8.6	Slump Tester/Vee Bee Testing Machine	1 no.
		8.7	Compaction Factor test Apparatus	1 no.					8.7	Compaction Factor test Apparatus	1 no.
		8.8	Electronic balance with 1gm least count (10/20Kg.capacity) including calibration weights.	1 no.					8.8	Electronic balance with 1gm least count (10/20Kg.capacity) including calibration weights.	1 no.
		8.9	Blain's air permeability apparatus	1 no.					8.9	Blain's air permeability apparatus	1 no.
		8.10	Vicat apparatus with dash pot and various needles	1 no.					8.10	Vicat apparatus with dash pot and various needles	1 no.
		8.11	Stopwatch	1 no.					8.11	Stopwatch	1 no.
		8.12	Le-Chatelier apparatus for soundness test of cement	1 no.					8.12	Le-Chatelier apparatus for soundness test of cement	1 no.
		8.13	Steel trowels for mixing cement paste	2 nos.					8.13	Steel trowels for mixing cement paste	2 nos.
		8.14	Cement mortar cube casting machine with motor and times witch complete	1no.					8.14	Cement mortar cube casting machine with motor and times witch complete	1no.
		8.15	7.06cm (50cm2) mortar cube moulds	2 nos.					8.15	7.06cm (50cm2) mortar cube moulds	2 nos.
		8.16	Metallic scoop, pan type container and china tray etc.	2 sets					8.16	Metallic scoop, pan type container and china tray etc.	2 sets
		8.17	Aggregate Impact testing machine	1no.					8.17	Aggregate Impact testing machine	1no.
		8.18	Aggregate crushing testing machine	1no.					8.18	Aggregate crushing testing machine	1no.
		8.19	Aggregate Abrasion testing machine	1no.					8.19	Aggregate Abrasion testing machine	1no.
		8.20	Electric thermostatic oven with display of temperature	1no.					8.20	Electric thermostatic oven with display of temperature	1no.
		8.21	Set of IS Sieves 40 mm and below up to 75 micron	1no.					8.21	Set of IS Sieves 40 mm and below up to 75 micron	1no.

		8.22 Automatic electric sieve shaker 1no. 8.23 Proving rings of 2000 KN,1000 KN,500 KN,and100 KN capacity 1 each 8.24 1.5Volt Avometer 1no. 8.25 Glass cylinders and Beakers 50- 500cc capacity 1set 8.26 Miscellaneous measuring gadgets like steel tape, Vernier, filler gauge etc. 2 sets 8.27 Magnifying glass 1no. 8.28 Level Surface Table for checking gauges (3mx2m) 1no. 8.29 pH meter & TDS meter (Digital) 1no. 8.30 Elongation and Flakiness Index Gauges 1 each			8.22 Automatic electric sieve shaker 1no. 8.23 Proving rings of 2000 KN,1000 KN,500 KN,and100 KN capacity 1 each 8.24 1.5Volt Avometer 1no. 8.25 Glass cylinders and Beakers 50- 500cc capacity 1set 8.26 Miscellaneous measuring gadgets like steel tape, Vernier, filler gauge etc. 2 sets 8.27 Magnifying glass 1no. 8.28 Level Surface Table for checking gauges (3mx2m) 1no. 8.29 pH meter & TDS meter (Digital) 1no. 8.30 Elongation and Flakiness Index Gauges 1 each
	9.0	REQUIREMENT OF IP BASED CCTV CAMERA AND SENSORS	No comments recieved	No change	
	9.1	IP based CCTV camera monitoring system for remote monitoring of sleeper production shall be installed. The live feed from these cameras installed at various critical locations (as given in the table below) shall be provided to concerned Zonal Railway and RDSO.	No comments recieved	No change	IP based CCTV camera monitoring system for remote monitoring of sleeper production shall be installed. The live feed from these cameras installed at various critical locations (as given in the table below) shall be provided to concerned Zonal Railway and RDSO.
	9.2	Installation of Sensors to automatically measure and record various parameters of concrete mix such as w/c ratio, moisture content of aggregates etc., production process such as stressing, vibration, curing, etc. and testing parameters such as cube strength, SBT test etc. The recorded parameters shall be transmitted to the Zonal Railway on real time basis.	No comments recieved	No change	Installation of Sensors to automatically measure and record various parameters of concrete mix such as w/c ratio, moisture content of aggregates etc., production process such as stressing, vibration, curing, etc. and testing parameters such as cube strength, SBT test etc. The recorded parameters shall be transmitted to the Zonal Railway on real time basis.
	9.3	Minimum requirement of IP based CCTV camera and sensors			Minimum requirement of IP based CCTV camera and sensors

		S. No.	ITEM	Minimum Requirement		REMARKS	No comments recieved	No change	S. No.	ITEM	Minimum Requirement		REMARKS
				CAMERA	SENSORS						CAMERA	SENSORS	
		A	RAW MATERIAL STORAGE AREA						A	RAW MATERIAL STORAGE AREA			
		1	Cement Godown	2	-	-			1	Cement Godown	2	-	-
		2	Prestressing steel Storage Area	1	-	Only 1 camera can be provided, if Prestressing steel storage & shoulder storage area are at same location and can be properly covered by one camera.			2	Prestressing steel Storage Area	1	-	Only 1 camera can be provided, if Prestressing steel storage & shoulder storage area are at same location and can be properly covered by one camera.
		3	Shoulder/Dowel Storage Area	1	-				3	Shoulder/Dowel Storage Area	1	-	
		4	Coarse Aggregate Storage Area	1	-	Only 1 camera can be provided if CA & FA storage area are at same location and can be properly covered by one camera.			4	Coarse Aggregate Storage Area	1	-	Only 1 camera can be provided if CA & FA storage area are at same location and can be properly covered by one camera.
		5	Fine Aggregate Storage Area	1	-				5	Fine Aggregate Storage Area	1	-	
		6	Admixture Storage Area	1	-				6	Admixture Storage Area	1	-	
		B	CONCRETE PRODUCTION AREA			Sensor based mechanism should be provided to remotely record and report weight of every ingredient of concrete in each batch.			B	CONCRETE PRODUCTION AREA			Sensor based mechanism should be provided to remotely record and report weight of every ingredient of concrete in each batch.
		1	Batching Plant Operator's place	1	-	-			1	Batching Plant Operator's place	1	-	-

		2	Coarse Aggregate CA-1	1	1	Only 1 camera can be provided if CA & FA storage bins can be properly covered by one camera. One Sensor each for testing moisture content in each chute.			2	Coarse Aggregate CA-1	1	1	Only 1 camera can be provided if CA & FA storage bins can be properly covered by one camera. One Sensor each for testing moisture content in each chute.
		3	Coarse Aggregate CA-2	1	1				3	Coarse Aggregate CA-2	1	1	
		4	Fine Aggregate (FA)	1	1				4	Fine Aggregate (FA)	1	1	
		5	Concrete mixing and delivery area.	1	-	-			5	Concrete mixing and delivery area.	1	-	-
		C	SLEEPER PRODUCTION AREA						C	SLEEPER PRODUCTION AREA			
		1	Production line for concreting	4	1	It should adequately cover the Sleeper casting, Mould preparation and Prestressing steel threading activities. One sensor for gang mould / bench counting.			1	Production line for concreting	4	1	It should adequately cover the Sleeper casting, Mould preparation and Prestressing steel threading activities. One sensor for gang mould / bench counting.
		2	Extension of Prestressing steel	1	1	One sensor for measuring extension of Prestressing steel			2	Extension of Prestressing steel	1	1	One sensor for measuring extension of Prestressing steel
		3	Application of Load for stressing of Prestressing steel	1	-	-			3	Application of Load for stressing of Prestressing steel	1	-	-
		4	Compaction of concrete /		1	One sensor per vibrator to			4	Compaction of concrete /		1	One sensor per vibrator to

			Vibration			measure RPM of vibrator and time of vibration.					Vibration			measure RPM of vibrator and time of vibration.
		5	Casting of concrete cubes / vibrating table	1	1	-				5	Casting of concrete cubes / vibrating table	1	1	-
		D	CURING AREA							D	CURING AREA			
		1	Steam curing chambers / rooms before demoulding	2	1	Minimum 2 cameras for covering entire steam curing area. One Sensor per Chamber to be provided. Temperature of steam curing to be measured and to be captured in the overall system being used at the centralized location.				1	Steam curing chambers / rooms before demoulding	2	1	Minimum 2 cameras for covering entire steam curing area. One Sensor per Chamber to be provided. Temperature of steam curing to be measured and to be captured in the overall system being used at the centralized location.
		2	Water Curing	4	-	Minimum 4 cameras for covering entire water curing area.				2	Water Curing	4	-	Minimum 4 cameras for covering entire water curing area.
		3	De-tensioning and demoulding area	2	-	Only 1 camera can be provided if both operations are at same location and can be covered properly by one camera.				3	De-tensioning and demoulding area	2	-	Only 1 camera can be provided if both operations are at same location and can be covered properly by one camera.
		E	TESTING LABORATORY							E	TESTING LABORATORY			
		1	Concrete Cube Testing	1	1	Only 1 camera can				1	Concrete Cube Testing	1	1	Only 1 camera can

2	Beam Testing	1	1	be provided if Concrete Cube Testing and Beam Testing are done at same location and can be covered properly by one camera.
3	Static Bending Test	1	1	-
4	Testing of various ingredients of concrete viz. Fine Aggregate, Coarse Aggregate, Cement Water, Admixture etc.	1	-	Should cover entire lab activities.
F	TURNOUT ASSEMBLY AREA	2	-	-
G	STACKING AREA	4	-	-
H	OTHERS	2	-	Entrance/Exit etc.

Note:

1. The IP based CCTV cameras should be of high resolution and sensors should be of high sensitivity.
1. All the recorded data shall be in un-editable format.
2. The data recording system should be capable of storing one year's data.
3. The recorded data shall be preserved in hard disks year wise for a period of 10 years.

CERTIFICATE

1. This is to certify that the information submitted in Paras 1 to 9 above is correct.
2. Testing of raw material shall be carried out as per relevant IS / IRS specifications, the details of raw material used is as given in as Annexure-2.
3. Record shall be maintained as per periodicity mentioned in Annexure-3 and approved QAP.

AUTHORISED SIGNATORY
NAME & SEAL

2	Beam Testing	1	1	be provided if Concrete Cube Testing and Beam Testing are done at same location and can be covered properly by one camera.
3	Static Bending Test	1	1	-
4	Testing of various ingredients of concrete viz. Fine Aggregate, Coarse Aggregate, Cement Water, Admixture etc.	1	-	Should cover entire lab activities.
F	TURNOUT ASSEMBLY AREA	2	-	-
G	STACKING AREA	4	-	-
H	OTHERS	2	-	Entrance/Exit etc.

Note:

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<td>1.0</td>
<td>Raw Material Details & Source of Raw Materials for Manufacturing of PSC Sleepers
<table>
<tr><th>S No.</th><th>Items</th><th>Remarks</th></tr>
<tr><td>1.1</td><td>Cement (Brand name)</td><td></td></tr>
<tr><td></td><td>Location of cement plant</td><td></td></tr>
<tr><td>1.2</td><td>Prestressing steel (approved source)</td><td></td></tr>
<tr><td>1.3</td><td>6mm MS Bar (confirming to IS: 2265)</td><td></td></tr>
<tr><td>1.4</td><td>Quarry name for CA1</td><td></td></tr>
<tr><td></td><td>Distance of quarry from the plant</td><td></td></tr>
<tr><td>1.5</td><td>Quarry name for CA2</td><td></td></tr>
<tr><td></td><td>Distance of quarry from the plant</td><td></td></tr>
<tr><td>1.6</td><td>Source name of Fine aggregate</td><td></td></tr>
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<tr><td>1.7</td><td>Dowel /Shoulder Source</td><td></td></tr>
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		5 absorption			5 absorption
	2.3	Prestressing steel for Prestressed Concrete S No. / Item / Remarks 2.3.1 Conforming to EN: 10138-2 specification 2.3.2 Type: Indented/Plain 2.3.3 Breaking Load & Elongation 2.3.4 0.2% Proof Stress 2.3.5 Young Modulus	No comments recieved	No change	Prestressing steel for Prestressed Concrete S No. / Item / Remarks 2.3.1 Conforming to EN: 10138-2 specification 2.3.2 Type: Indented/Plain 2.3.3 Breaking Load & Elongation 2.3.4 0.2% Proof Stress 2.3.5 Young Modulus
	2.4	Water S No. / Item / Remarks 2.4.1 Testing agency (Copy to be enclosed) 2.4.2 pH value= 2.4.2 Chloride content (mg/lit)= 2.4.2 Sulphate content (mg/lit)= 2.4.2 Inorganic Solids (mg/lit)= 2.4.2 Organic Solids (mg/lit)= 2.4.2 Suspended Solids (mg/lit)=			Water S No. / Item / Remarks 2.4.1 Testing agency (Copy to be enclosed) 2.4.2 pH value= 2.4.2 Chloride content (mg/lit)= 2.4.2 Sulphate content (mg/lit)= 2.4.2 Inorganic Solids (mg/lit)= 2.4.2 Organic Solids (mg/lit)= 2.4.2 Suspended Solids (mg/lit)=
	2.5	Shoulders/dowels as per design of fastening Shoulder S No. / Items / Remarks 2.5.1 Name of Suppliers	No comments recieved	No change	Shoulders/dowels as per design of fastening Shoulder S No. / Items / Remarks 2.5.1 Name of Suppliers

		2.5.2 Cross check Heat nos. with IC issued by purchaser / Inspection authority 2.5.3 BHN value= 2.5.4 Phosphorous content (%) 2.5.5 Condition of storage in general			2.5.2 Cross check Heat nos. with IC issued by purchaser / Inspection authority 2.5.3 BHN value= 2.5.4 Phosphorous content (%) 2.5.5 Condition of storage in general
	2.6	Dowel S No. / Items / Remarks 2.5.1 Name of Suppliers 2.5.2 Cross check with IC issued by purchaser / Inspection authority 2.5.3 Condition of storage in general	No comments recieved	No change	Dowel S No. / Items / Remarks 2.5.1 Name of Suppliers 2.5.2 Cross check with IC issued by purchaser / Inspection authority 2.5.3 Condition of storage in general
	2.6	Admixture S No. / Items / Remarks 2.6.1 Conforming to IS:9103 2.6.2 Properties	No comments recieved	No change	Admixture S No. / Items / Remarks 2.6.1 Conforming to IS:9103 2.6.2 Properties

Annexure-2		**MAINTENANCE OF RECORDS AND DOCUMENTATION AT THE CONCRETE SLEEPER PLANT** Following records shall be maintained as per approved QAP and formats **1.0** INVENTORY OF RAW MATERIALS: **1.1** Aggregates: a) Coarse Aggregate (CA1) 20 to 10 mm b) Coarse Aggregate (CA2) 10 mm and down. C) Fine Aggregate (River Sand & Crushed Stone sand) Details of Receipt, Source, Date of receipt, Truck Nos., Quantity, Balance, Remarks about quality and signature. **1.2** Prestressing steel (EN:10138-2): Date of Receipt, Truck No., Nos. of wire, Serial No. of each wire bundle, Source (Name of the firm), Details of test certificate, quantity, shift-wise consumption, balance and remarks whether test certificate is OK. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which Prestressing steel issued in which sleeper. **1.3** Special Cement (IS 269): Date of receipt, Source, quantity, Shift-wise consumption, balance, whether Test Certificate received, Details of Lab Tests done at site, Consistency, Initial & Final setting time, Fineness and 7 days mortar cube strength. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which cement used in which sleeper. **1.4** Shoulders/ Dowels: Date of Receipt, Truck No., Quantity, Source (Name of manufacturer), Consumption, Balance etc. shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which shoulder used in which sleeper. **1.5** Admixture (IS 9103): Date of receipt, Source & conformance to IS codes, quantity, Shift-wise consumption, balance, whether	No comments recieved	No change	**MAINTENANCE OF RECORDS AND DOCUMENTATION AT THE CONCRETE SLEEPER PLANT** Following records shall be maintained as per approved QAP and formats **2.0** INVENTORY OF RAW MATERIALS: **2.1** Aggregates: c) Coarse Aggregate (CA1) 20 to 10 mm d) Coarse Aggregate (CA2) 10 mm and down. C) Fine Aggregate (River Sand & Crushed Stone sand) Details of Receipt, Source, Date of receipt, Truck Nos., Quantity, Balance, Remarks about quality and signature. **2.2** Prestressing steel (EN:10138-2): Date of Receipt, Truck No., Nos. of wire, Serial No. of each wire bundle, Source (Name of the firm), Details of test certificate, quantity, shift-wise consumption, balance and remarks whether test certificate is OK. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which Prestressing steel issued in which sleeper. **2.3** Special Cement (IS 269): Date of receipt, Source, quantity, Shift-wise consumption, balance, whether Test Certificate received, Details of Lab Tests done at site, Consistency, Initial & Final setting time, Fineness and 7 days mortar cube strength. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which cement used in which sleeper. **2.4** Shoulders/ Dowels: Date of Receipt, Truck No., Quantity, Source (Name of manufacturer), Consumption, Balance etc. shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which shoulder used in which sleeper. **2.5** Admixture (IS 9103):

		Test Certificate received shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate with production of PSC sleepers. 2.0 PRODUCTION RECORDS: **2.1** Production Register: Batch Nos., Nos. Cast in each shift, cumulative production, Bench Nos., Cubes and sleeper testing details, Summary of Rejected and Usable sleepers shall be recorded in the printed register Daily production register shall be maintained for each design of sleepers separately. **2.2** Tension Register: **2.3** Steam Curing (Before demoulding) Records: 3.0 TESTING RECORDS: a) Sieve analysis with combined granulo-metric analysis of aggregates. b) Combined Flakiness and Elongation indices test. c) Moisture content and modified (adjusted) quantities. d) Records of Moulds and repairs. e) Details of Pressure Gauges, Proving Rings and calibration of Pressure gauges. f) Steam curing and Release cube testing. g) Dimensional checking. h) Proforma for individual batch production records. i) Proforma for monthly progress Report. j) Standard deviation and characteristic strength of i. Release (Steam cured) cubes.			Date of receipt, Source & conformance to IS codes, quantity, Shift-wise consumption, balance, whether Test Certificate received shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate with production of PSC sleepers. 2.0 PRODUCTION RECORDS: **2.4** Production Register: Batch Nos., Nos. Cast in each shift, cumulative production, Bench Nos., Cubes and sleeper testing details, Summary of Rejected and Usable sleepers shall be recorded in the printed register Daily production register shall be maintained for each design of sleepers separately. **2.5** Tension Register: **2.6** Steam Curing (Before demoulding) Records: 3.0 TESTING RECORDS: l) Sieve analysis with combined granulo-metric analysis of aggregates. m) Combined Flakiness and Elongation indices test. n) Moisture content and modified (adjusted) quantities. o) Records of Moulds and repairs. p) Details of Pressure Gauges, Proving Rings and calibration of Pressure gauges. q) Steam curing and Release cube testing. r) Dimensional checking. s) Proforma for individual batch production records. t) Proforma for monthly progress Report. u) Standard deviation and characteristic

ii. 15 days cured cubes.

iii. Sleeper cracking loads/ Rail Seat bottom and centre top.

k) Dispatch Register.

4.0 STATISTIC ALANALYSIS & REPORT TO RDSO:

Statistical analysis along with calculations shall be submitted to Railway/RDSO every month. The statistical analysis should be carried out for following parameters–

i. Release (Initial/Dry cured) cube strength

ii. 15 days cured cube strength

iii. Flexural Beam strength

iv. SBT results

Similar analysis shall be carried out for each month and a consolidated report shall be submitted for a given financial year.

5.0 CALIBRATION RECORDS:

The record shall be maintained for calibration of weigh batcher, Water meter, SBT machine, Concrete cube test machine, cement mortar cube testing machine, Beam testing machine and tensioning jacks. The schedule is given in Para 6.0 below.

6.0 CALIBRATION SCHEDULE:

Calibration of all the pressure gauges shall be done in the plant itself. Calibration of proving rings should be got done from a NABL accredited Labs/Govt Labs or reputed organization like the IITs or NITs etc. The frequencies of calibration of all the pressure gauges and equipment are as follows:-

SN.	Equipment	Frequency (For PSC Line sleeper)

strength of

iv. Release (Steam cured) cubes.

v. 15 days cured cubes.

vi. Sleeper cracking loads/ Rail Seat bottom and centre top.

v) Dispatch Register.

4.0 STATISTIC ALANALYSIS & REPORT TO RDSO:

Statistical analysis along with calculations shall be submitted to Railway/RDSO every month. The statistical analysis should be carried out for following parameters–

v. Release (Initial/Dry cured) cube strength

vi. 15 days cured cube strength

vii. Flexural Beam strength

viii. SBT results

Similar analysis shall be carried out for each month and a consolidated report shall be submitted for a given financial year.

5.0 CALIBRATION RECORDS:

The record shall be maintained for calibration of weigh batcher, Water meter, SBT machine, Concrete cube test machine, cement mortar cube testing machine, Beam testing machine and tensioning jacks. The schedule is given in Para 6.0 below.

6.0 CALIBRATION SCHEDULE:

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1	15 cm concrete cube testing machine (2000 KN Capacity)	As per Annexure -I of IRS/T-39
2	Cement mortar cube testing machine (500 KN Capacity)	
3	Sleeper static Bend Test machine sleepers (1000 KN Capacity)	
4	Pre tensioning Equipment of suitable capacity	
5	Concrete beam testing machine (100 KN Capacity)	
6	Aggregate weigh batcher	
7	Cement Weighing Equipment	
8	Water Meter	
9	Admixture Dispenser	
10	Master gauges for checking correctness of dimensions measuring gauges.	
11	Dimension checking gauges.	
12	Proving Rings (All the Four-2000 KN, 1000 KN, 500 KN, 100 KN)	
13	Weights & measures	
14	Tachometer	

Note:-

1) The items referred at S. Nos. 1 to 5 above should be calibrated by proving ring by the sleeper plant itself.

SN.	Equipment	Frequency (For PSC Line sleeper)
1	15 cm concrete cube testing machine (2000 KN Capacity)	As per Annexure -I of IRS/T-39
2	Cement mortar cube testing machine (500 KN Capacity)	
3	Sleeper static Bend Test machine sleepers (1000 KN Capacity)	
4	Pre tensioning Equipment of suitable capacity	
5	Concrete beam testing machine (100 KN Capacity)	
6	Aggregate weigh batcher	
7	Cement Weighing Equipment	
8	Water Meter	
9	Admixture Dispenser	
10	Master gauges for checking correctness of dimensions measuring gauges.	
11	Dimension checking gauges.	
12	Proving Rings (All the Four-2000 KN, 1000 KN, 500 KN, 100 KN)	
13	Weights & measures	

2) The items referred at S. Nos. 6 & 7 should be calibrated by the dead weights and item at S. No.8 by measuring cans that should be available in the plant.

3) The proving ring should be calibrated from a NABL accredited Labs/Govt Labs or reputed organization like the IITs or NITs etc.

4) The record of calibration of the all the above equipments should be maintained in a manner that previous record can be easily connected.

5) The calibration can be done more frequently at the discretion of the inspecting Official.

CERTIFICATE

This is to certify that the information given as above is correct and if the information is found to be false then the firm will accept the action taken by Railway.

AUTHORISED

SIGNATORY

NAME & SEAL

Note: Relevant formats required for maintaining records of tests conducted on various raw materials, concrete cubes and sleepers shall be as given in Part-C.

PART-C

14	Tachometer	

Note:-

1) The items referred at S. Nos. 1 to 5 above should be calibrated by proving ring by the sleeper plant itself.

2) The items referred at S. Nos. 6 & 7 should be calibrated by the dead weights and item at S. No.8 by measuring cans that should be available in the plant.

3) The proving ring should be calibrated from a NABL accredited Labs/Govt Labs or reputed organization like the IITs or NITs etc.

4) The record of calibration of the all the above equipments should be maintained in a manner that previous record can be easily connected.

5) The calibration can be done more frequently at the discretion of the inspecting Official.

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AUTHORISED

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NAME & SEAL

Note: Relevant formats required for maintaining records of tests conducted on various raw materials, concrete cubes and sleepers shall be as given in Part-C.

FORMAT-XVI		Hardness of insert test has been added. 1% of Inserts are to be checked for hardness.	No comments recieved	No change	Hardness of insert test has been added. 1% of Inserts are to be checked for hardness.
FORMAT-XVI		Hardness of insert test has been added. 1% of Inserts are to be checked for hardness.	No comments recieved	No change	Hardness of insert test has been added. 1% of Inserts are to be checked for hardness.