SPECIFICATION No TI/SPC/OHE/ATD/0060 (Rev.2)

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION
FOR
THREE PULLEY TYPE REGULATING EQUIPMENT WITH MODIFIED PULLEY GROOVED, THREE PULLEY TYPE REGULATING EQUIPMENT WITH 2400 KGF TENSION & FIVE PULLEY AUTO TENSIONING DEVICES
FOR
25 kV AC TRACTION

(For official use only)

Issued by:

TRACTION INSTALLATION DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226 011

	Prepared by	Checked by	Issued by
Signature			
Designation	JE/TI	DTI-2	EDTI

THREE PULLEY TYPE REGULATING EQUIPMENT WITH MODIFIED PULLEY GROOVED, THREE PULLEY TYPE REGULATING EQUIPMENT WITH 2400 KGF TENSION & FIVE PULLEY AUTO TENSIONING DEVICES.

1.0 SCOPE:

1.1 This specification has been prepared by merging of the specification of three pulley type regulating equipment with modified pulley grooved, three pulley type regulating equipment with 2400 kgf tension & Five pulley Auto tensioning devices.

1.2 This Specification covers the requirements of three pulley type regulating equipment with modified pulley grooved, three pulley type regulating equipment with 2400 kgf tension & five pulley auto tensioning devices for 25 kV AC Traction Overhead lines.

1.3 **Three pulley type regulating equipment with modified pulley grooved**: It is to be installed at either end of traction overhead lines for providing a constant tension of 2000 kg in traction overhead line conductors at different ambient temperatures by using balancing weights of 665 kgf. It comprises of a Pulley block consisting of two pulleys towards anchoring mast/portal and one movable pulley on the OHE side. The assembly shall have anti-falling device so that in case of breakage of stainless steel wire rope and/or clevis & eye, the overhead conductors are not allowed to fall.

1.4 **Three pulley type regulating equipment with 2400 kgf tension**: It is to be installed at either end of traction overhead lines for providing a constant tension of 2400 kg in traction overhead line conductors at different ambient temperatures by using balancing weights of 800 kgf. It comprises of a pulley block consisting of two pulleys towards anchoring mast/portal and one movable pulley on the OHE side. The assembly shall have anti-falling device so that in case of breakage of stainless steel wire rope and/or clevis & eye, the overhead conductors are prevented from falling. For semi high speed (160-200kmph) lines, Overhead Equipment tension shall be 2400 kgf i.e. 1200kgf in Catenary wire and 1200kgf in Contact wire. ~~For higher tension in Overhead Equipment, three pulley Automatic Tensioning Device assembly with 2400 kg tension in overhead line is required.~~

1.5 **Five Pulley Auto Tensioning Device**: It shall be used for 3000 kgf tension, 1500 kgf in contact wire and 1500 kgf in catenary wire, the existing five Pulley ATD which has been developed for 2400 kgf shall be used for 3000 kgf with special arrangement of counter weight in which 600 kg weight shall be provided in double stack of 300 kg in parallel as a balancing weight of five Pulley ATD.

1.6 The Indian Railways employ simple polygonal Cadmium Copper Catenary and Copper Contact wire in OHE for supplying power to Electric locomotives. For ensuring reliable current collection by Pantographs of Electric locomotives, Auto Tensioning Devices (henceforth referred as ATD) are installed at either end of Traction overhead line for providing a constant tension in traction overhead line conductors irrespective of temperature variation.

1.7 The "Make in India" policy of government of India shall be applicable.

1.8 Following References of Indian Standard, British Standard and IR Specification or its **latest edition** shall be followed:

i	IS 617: 1994(R2014)	CASTALUMINIUMANDITSALLOYSINGOTS AND CASTINGS FOR GENERAL ENGINEERINGPURPOSES - SPECIFICATION
ii	IS 3091:1999(R2015)	ALUMINIUM BRQNZE INGOTS AND CASTINGS FOR OVERHEAD FITTINGS IN 'ELECTRIC TRACTION - SPECIFICATION
iii	TI/SPC/OHE/FASTNERS /0120 (Rev.1) or latest	Specification for Steel Fastners and Stainless Steel Fasteners.
iv	TI/SPC/OHE/FITTINGS/ 0130(10/13) or latest	Specification for 25 kV, AC OHE Fittings.
v	ETI/OHE/13(4/84) or	Specification for Hot dip Zinc Galvanising of

	latest	Steel Mast, Tubes, Fittings used on 25kV AC OHE.
vi	BS EN 10090:1998	Valve steels and alloys for internal combustion engines
vii)	IS:1570(Part-5)- 1985 (Re-affirmed-2014)	Schedules for wrought steels: Part 5 stainless and heat - Resisting steels.
viii)	IS:549 – 2005 (R2016)	Specification for Spilt Pins
ix)	IS:2062 -2011(R 2016)	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION
x)	IS 2004 - 1991 (Re affirmed 2001)	Specification for Carbon Steel Forgings for General Engineering Purposes

2.0 ENVIRONMENTAL & WORKING CONDITIONS: The Automatic Tensioning Device assembly is expected to be used in varying atmospheric and climatic conditions. The environment factors are expected to vary in the range as tabulated below.

i)	Ambient air temperature	0^0C to (+)65^0C
ii)	Maximum temperature of metallic object in sun.	70^0C
iii)	Minimum Temperature	(-) 10°C
iii)	Maximum relative humidity	100%
iv)	Annual rainfall	Dry Arid regions and also heavy monsoon affected regions with rainfall ranging from 1750 to 6250 mm
v)	Maximum number of Thunder storm days per annum	85
vi)	Maximum number of Dust storm days per annum	35
vii)	Number of Rainy days per annum.	120
viii)	Basic wind pressure	216 kgf/m^2
ix)	Altitude	Upto-2500 m
x)	Corrosion Resistance	Corrosion Resistance: The ATD assembly shall be designed to work in humid salt laden and corrosive atmosphere .The maximum values of the condition shall be as under: Maximum PH value : 8.5 Sulphate : 7 mg/liter Max concentration : 6 mg/liter of chlorine Max. conductivity :130 micro Siemens /cm

3.0 Manufacture of Auto Tensioning Device

The Auto Tensioning Device shall be manufactured in accordance with the RDSO Drawings mentioned herewith. The manufacturer shall submit their own drawings, indicating the tolerances and material Specifications of all parts, for approval of RDSO before undertaking manufacture of proto-types.

3.1 THREE PULLEY TYPE REGULATING EQUIPMENT WITH MODIFIED PULLEY GROOVED.

SN	Drawing No.	Description
1.	TI/DRG/OHE/ATD/RDSO/00001/99/3	Regulating equipment (three pulley type) 3:1 ratio
2.	TI/DRG/OHE/ATD/RDSO/00002/99/4	Part details of regulating equipment (three pulley type) 3:1 ratio
3.	TI/DRG/OHE/ATD/RDSO/00008/05/0	Drawing of M-18 X 75/32 bolt with castle nut
4.	TI/DRG/OHE/ATD/RDSO/00005/02/1	Part drawing for clevis & eye forged (RI 5322-1)
5.	ETI/OHE/P/5341 REV 'A'	Part drawing for stainless steel rope end fitting (RI 5341)
6.	SKF 63052RS1, NBC 6305 LLU or FAG 6305 2RSR	Bearings

3.2 Drawing no & Specification of Three pulley type regulating equipment with 2400 kgf tension.

SN	Drawing No.	Description
1.	TI/DRG/OHE/ATD2400/RDSO/00001/16/1Rev.1	Regulating equipment (three pulley type) 3:1 ratio
2.	TI/DRG/OHE/ATD2400/RDSO/00002/16/2 Rev.2	Part details of regulating equipment (three pulley type) 3:1 ratio
3.	TI/DRG/OHE/ATD/RDSO/00008/05/0	Drawing of M-18 X 75/32 bolt with castle nut
4.	TI/DRG/OHE/ATD/RDSO/00005/02/1	Part drawing for clevis & eye forged (RI 5322-1)
5.	ETI/OHE/P/5341 REV 'A'	Part drawing for stainless steel rope end fitting (RI 5341)
6.	SKF 6307 2RS1, NBC 6705 LLU or FAG 6307 2RSR	Bearings

3.3 Drawings & specification for five Pulley type Auto Tensioning Device.

SN	Drawing No.	Description
1	TI/DRG/OHE/ATD/RDSO/000012/15/0 , Rev-1	Regulating equipment (five pulley type) 5:1 ratio
2	TI/DRG/OHE/ATD/RDSO/000013/15/0 ,Rev.-1	Part details of regulating equipment (five pulley type) 5:1 ratio
3	TI/DRG/OHE/ATD/RDSO/000014/15/0 , Rev.-2	Pulley Details of Regulating equipment (Five pulley type) 5:1 ratio
4	TI/DRG/OHE/ATD/RDSO/00008/05/0	Drawing of M-18 X 75/32 bolt with castle nut
5	TI/DRG/OHE/ATD/RDSO/00005/02/1	Part drawing for clevis & eye forged(RI 5322-1)
6	ETI/OHE/P/5341 REV 'A'	Part drawing for stainless steel rope end fitting (RI 5341)
7.	TI/DRG/OHE/C.WTASY/00001/20/0	Counter weight arrangement drawings.
8.	SKF 6305 2RS1, NBC 6305 LLU or FAG 6305 2RSR	Bearings

3.4 The Auto Tensioning Device shall be used with the Wire Rope manufactured as per RDSO Specification No TI/SPC/OHE/WR/1060 (Rev.1) or latest.

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3.5 Part Identification Number, Manufacturers Monogram and month/year of manufacture shall be engraved on each part of the Assembly.

3.6 All parts of the Assembly shall be free from casting/manufacturing defect and other irregularities.

3.7 The Aluminum, Aluminum-alloy and Aluminum-bronze castings, wherever specified, shall conform to RDSO Specification No. TI/SPC/OHE/FITTINGS /0130 (Rev.1) or latest.

3.8 The Stainless steel parts, wherever specified, shall be made of Stainless Steel grade 316 S 16 ~~of BS: 970(Part 4) – 1970~~ EN 10090:1998 ~~or grade AISI 316 .~~

3.9 All ferrous Fasteners wherever specified, shall be hot dip galvanized. The weight of zinc coating shall not be less than 400 gm/$m^{2.}$

3.10 All ferrous parts except Fasteners, used in the Auto Tensioning Device shall be hot dip galvanized, to RDSO Specification No ETI/OHE/13 (4/84) or latest. The weight of zinc coating shall not be less than 610 gm/m^2.

3.11 The Test Bars of Aluminum-alloy and Aluminum- bronze for mechanical tests shall be from the same melt from which the parts/components of Auto Tensioning Device are cast. The test bars shall conform to IS 617:1994 (R2014) and IS 3091-1999 (R 2015) respectively.

3.12 Split Pins shall be of copper and shall conform to IS: 549-2005 (R 2016).

3.13 ~~The Bearings used shall be SKF 6305 2RS1, NBC 6305 LLU or FAG 6305 2RSR. Bearings shall be procured form the RDSO approved manufacturers directly.~~

3.14 All components of Auto Tensioning Device shall be freely interchangeable between one assembly and another.

3.15 Any deviation from this Specification, inculcated to improve the performance, utility and efficiency of the Equipment shall be given due consideration provided full particulars with justification thereof are furnished.

3.16 Forged fittings shall conform to Specification No IS 2004-1991 (R 2001). Forged fittings shall be procured from RDSO approved manufacturer directly.

3.17 SGCI fittings wherever specified shall conform to Specification No. TI/SPC/OHE/FITTINGS/0130 (Rev.1) or latest. SGCI fittings shall be procured from RDSO approved manufacturer directly.

3.18 Fasteners shall conform to Specification No TI/SPC/OHE/FASTENERS/0120 (Rev.1) or latest. Fasteners shall be procured from RDSO approved vendors directly.

3.19 The Automatic Tensioning Device shall be able to withstand the polluting and corrosive atmosphere such as in the coastal areas, industrial areas, in the vicinity of Chemical Plants and Diesel Loco Sheds.

3.20 Bearing shall be procured from RDSO approved manufacturers directly.

3.21 **Interchangebility :** All components of regulating Equipments shall be freely inter-changeable between one assembly and other of same type.

3.22 **Deviation form the specification:-** Any deviation from this specification to improve the performance, utility and efficiency of the equipment proposed by the manufacturer will be given due consideration provided full particulars with justification thereof are furnished.

3.23 **Freedom from Defects:** All parts of regulating equipment's shall be free from casting/manufacturing defects and other irregularities. No repairs shall be done to the castings to hide defects.

4. **TESTS**

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4.1 The manufacturing process shall be inspected and tested by the Director General/ (TI), RDSO [(DG)/TI/RDSO] or his authorized representative at the manufacturer's works. All tests specified in clause 5.0 shall normally be carried out at the manufacturer's works. The firm shall arrange, without making any claim or charges, all the necessary machinery, apparatus, Labour and assistance required to get the specified tests conducted in the presence of purchaser's representative. If certain facilities are not available for the tests, manufacturer may arrange these tests at NABL accredited/Government laboratory, at his own cost with the approval of RDSO.

4.2 Test certificate of chemical composition shall be obtained from the suppliers of the raw material procured/processed. The manufacturer shall also check the chemical composition of every lot of raw material purchased and keep the record of the same. The certificates of these shall be produced at the time of inspection.

4.3(a) Before giving call to RDSO for testing of the prototype of the Auto Tensioning Device, the manufacturer shall submit a detailed test schedule consisting of the details of each test, nature of the test , venue of the test, the duration of each test and the total number of days required to complete the test at one stretch. If not completed in one stretch it should be carried out in second visit Once the test schedule is approved, the test shall invariably be carried out accordingly. However, during the process of type test or even later, RDSO/Purchaser's representative reserves the right to conduct any additional test (s) besides those specified herein , on any Equipment/sub-system or system so as to test the system as per requirement or for gaining additional information and knowledge.

4.3(b) In case, any dispute or disagreement arises between the manufacturer and RDSO/Purchaser during the process of testing, regarding the type test and/or the interpretation and acceptability of the type test results, it shall be brought to the notice of Director General (Traction Installation), Research Designs & Standards Organisation, Manak Nagar, Lucknow-226011, whose decision shall be final and binding.

4.3(C) ~~In the event of the tests are not completed at one stretch, for any reason attributable to the successful tenderer/manufacturer/RDSO and it is required for the representative of the purchaser/ Director General (Traction Installation), Research Designs and Standards Organisation to visit again or more number of times to the works of the successful tenderer / Manufacturer or other Place(s) for continuing and /or completing the tests on the prototype (s) of the equipment, the successful tenderer/manufacturer shall reimburse to the Purchaser/Director General (Traction Installation), Research Designs and Standards Organisation the costs for the representative having to visit the works or other place (s) for the tests more than once. The costs as claimed by the Director General (Traction Installation), Research Designs and Standards Organisation shall be paid through a Demand Draft to the concerned Accounts Officer of the Director General (Traction Installation), Research Designs and Standards Organisation as shall be advised to the successful tenderer/manufacturer.~~ The RDSO ISO Document No: QO-D-8.1-17 Version No:1.1 Date Effective: 19.06.2020 (or latest) for Logistics provision by vendor for inspections shall be followed.

5.0 Tests

SN.	Test	Type Test	Acceptance Test	Routine Test	Clause No. /Standard / Drawing
5.1	Tests on Components of Auto Tensioning Device				
5.1.1	Visual Examination	Y	Y	Y	Cl. No. 6.1

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5.1.2	Verification of Dimensions	Y	Y	Y	Cl. No. 6.2
5.1.3	Chemical composition Test on Test Bars and Components.	Y	Y	N	Cl. No. 6.3
5.1.4	Mechanical test on Test Bar	Y	Y	N	Cl. No. 6.4
5.1.5	Load test on Clevis & Rope End Fitting	Y	Y	N	Cl. No. 6.6
5.1.6	Radiographic examination of Aluminium Alloy and Aluminium Bronze Castings	Y	N	N	Cl. No. 6.5
5.1.7	Galvanising Test	Y	Y	N	Cl. No. 6.7
5.1.8	Test on Fasteners	As per Specification No. TI/SPC/OHE/FASTNERS/ 0120 (Rev.1) or latest.			Cl. No. 6.8
5.2	Tests on Auto Tensioning Device Assembly				
5.2.1	Mechanical Endurance Test	Y	N	N	Cl. No. 6.9
5.2.2	Test to check the Mechanical Advantage	Y	N	N	Cl. No. 6.10
5.2.3	Proof Load Test	Y	N	N	Cl. No. 6.11

Note: ~~Clause 6.8 for those firms which are manufacturing fasteners in house, if Fasteners are purchased by the firm from RDSO/CORE approved vendors directly, and then RITES Inspections certificate of fasteners shall be submitted.~~

5.3 **Sampling for Type Test**: For the Type Tests, five units shall be manufactured. Three units shall be subjected to type tests given at SN 5.1 and remaining two units shall be subjected to tests given at SN 5.2.

5.4 **Bulk manufacture:** Only after clear written approval of the results of tests on the prototype has been communicated by the DG (TI), RDSO/Purchaser to the manufacturer, they shall take up bulk manufacturing of Auto Tensioning Devices which shall be strictly with the same material and process as adopted for the prototype. In no circumstances, materials other than those approved in the prototype shall be used for bulk manufacturing.

5.5 **Criteria for Acceptance:**

5.5.1 Lot shall be formed from the same production batch of not more than 100 units. The Five units from each batch shall be selected at random from the offered lot for tests. Samples from three selected units shall be subjected to the tests given at SN 5.1. Remaining two units shall be subjected to tests given at SN 5.2.2 & 5.2.3.

5.5.2 The castings essentially belonging to the same melt and manufactured from the same raw material. Three assemblies of regulating equipment shall be selected at random from every lot, after it has been subjected to the routine tests. The manufacturer shall also offer three test bars each of aluminium bronze and aluminium alloy pertaining to melt of every lot. The components of these assemblies and the test bars shall be subjected to the tests specified in clause 5.0.

5.5.3 If any sample fails to comply with any test(s) specified in this Specification, test(s) shall be repeated on three fresh samples, taken from the same Batch but limited to the test(s) in which failure occurred. If during the retest(s) any sample fails, the Batch represented by the sample shall be deemed not to comply with Specification and the Batch shall be rejected. The rejected Batch shall be destroyed in the presence of the Inspecting official so that they can not be used on the Railways.

5.5.4 Inspector shall affix an indelible stamp, punch mark or a label indicating the date of inspection and name of inspector. The label shall be affixed with special glue so that it does not come off.

6.0 Test methods:

6.1 Visual examination

6.1.1 All the components of the Auto Tensioning Device shall be visually examined for good work-manship and bright and smooth surface finish and freedom from defects stipulated in relevant specification.

6.1.2 The components of the Auto Tensioning Device shall be checked for Identification Nos and firms Monogram as mentioned in the relevant Drawing.

6.1.3 The grooves on the Pulley shall be smooth, clean and uniform all along.

6.1.4 The zinc coating on the Galvanised components shall be uniform, smooth and free from imperfections such as flux, ash and dross inclusions, bare patches, black spots, pimples, lumpiness and runs, rust stains, bulky white deposits and blisters. The terms have been defined in IS: 2629-1985 (R 1994).

6.1.5 The Forged heads of Bolts and Tie Rods and holes of Nuts, Washers, Lock Nuts and Locking Plates shall be concentric.

6.1.6 The Bearings shall be examined for the free running. The bearing shall be SKF, NBC or FAG make.

6.2 Verification of Dimensions

6.2.1 **Verification of Groove Profile:** The diameter of the pulley, groove radius of the pulleys at various points on the groove shall be measured by groove gauge during type test, acceptance test and routine inspection. Pulley groove radius shall be within 4.55 mm to 4.75 mm. If Pulley groove radius is found to be less than the specified, pulley groove should be re-machined to achieve specified groove radius. Pulley shall be discarded, if groove radius is found more than 4.75 mm. The Pulleys shall be marked at two locations for checking the groove radius before and after the Endurance test and Proof Load test. Pulley groove profile shall be checked with Go, No Go gauge, which shall be calibrated by NABL lab.

6.2.2 **Verification of Other Critical Dimensions:** The dimensions of the castings and other components of the Auto Tensioning Device shall conform to the Drawings approved by RDSO.

6.3 **Chemical composition:** The manufacturer shall submit the Test Bars of Aluminium Alloy and Aluminium Bronze from the same melt which represents the lot for chemical analysis. The Test Bars shall be chemically analysed after the mechanical tests. The RDSO/Purchaser shall be at liberty to analyse any other Fittings/ Components in addition to Test Bars. The Test Bars of Aluminium Bronze and Stainless Steel Wire Rope End Fitting (RI-5341) shall meet the requirement of IS: 3091-1999 (R 2015).

(i) **Three pulley type regulating equipment with modified pulley grooved:** The test bars of aluminium alloy, pulley (RI 5512), grease seal(RI 5315), wedge(RI 5321) shall meet the requirement of grade 4600M of IS:617-1994.

The material of axles (RI 5322, RI 5508) shall conform to grade 316S16 of ~~BS: 970(part-4)-1970 or grade AISI 316~~ EN 10090:1998. Mild steel components pulley bearing bush(RI 5333), bush bearing for grease seal (RI 5315), Pulley arms (RI 5510, RI 5511), angle spacers (RI 5505-1, RI 5352-1), locking plates(RI 5336, RI 5323) , pulley arm spacers(RI 5503), tie rod(RI 5509) , snap head pin and

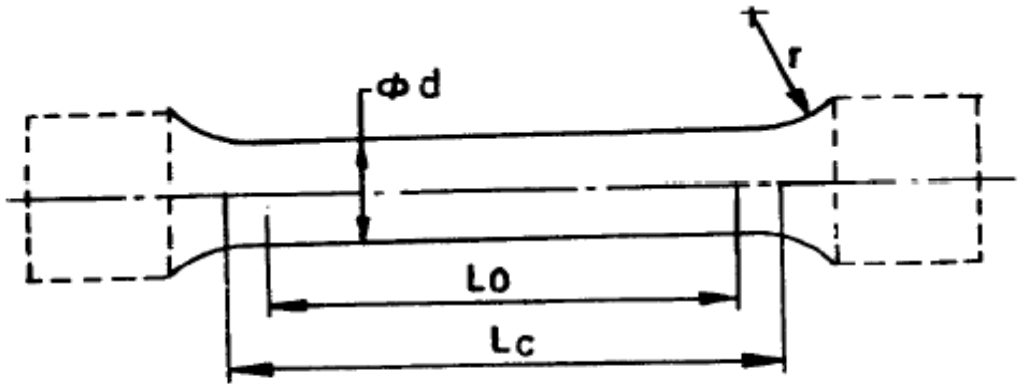
washers shall meet the requirement of IS 2062:2011(R 2016) Gr'A'. Forged clevis and eye (RI 5322-1) shall meet the requirement of class II of IS2004 -1991 (R 2001). Split pin shall be of copper as per IS:191-2007 (R 2016).

(ii) **THREE PULLEY TYPE REGULATING EQUIPMENT WITH 2400 KGF TENSION.**
The test bars of aluminium alloy, pulley(RI 5512-1), grease seal(RI 5315-1), wedge(RI 5321) shall meet the requirement of grade 4600M of IS:617-1994.
The material of axles (RI 5332-1, RI 5508-1) shall conform to grade 316S16 of ~~BS: 970(part 4) 1970 or grade AISI 316~~ EN 10090:1998. Mild steel components pulley bearing bush(RI 5333-1), bush bearing for grease seal (RI 5315-1), Pulley arms (RI 5510-1, RI 5511-1), angle spacers (RI 5505-1, RI 5352-1), locking plates(RI 5336, RI 5323) , pulley arm spacers(RI 5503), tie rod(RI 5509-1) , snap head pin and washers shall meet the requirement of IS 2062:2011 (R 2016) Gr'A'. Forged clevis and eye (RI 5322-1) shall meet the requirement of class II of IS2004 -1991 (R 2001). Split pin shall be of copper as per IS:191-2007 (R 2016).

(iii) **FOR FIVE PULLEY**: The test bars of aluminium alloy, Pulley (RI 5401, 5402, 5403), grease seal (RI 5315), wedge (RI 5321) shall meet the requirement of grade 4600M of IS: 617-1994 (R 2016).
The material of axles (RI 5332, RI 5411, and RI 5412) shall **conform** to grade 316S16 of ~~BS 970: pt 4 1970 or grade AISI 316~~ EN 10090:1998 .
Mild steel components pulley bearing bush(RI 5333), bush bearing for grease seal (RI 5315), Pulley arms (RI 5421, RI 5422, RI 5423), angle spacers (RI 5431), locking plates(RI 5336) , pulley arm spacers(RI 5424), tie rod(RI 5432) and washers shall meet the requirement of IS 2062:2011 (R 2016) Gr'A'. Forged clevis and eye (RI 5322-1) shall meet the requirement of class II of IS2004 -1991 (2001). Split pin shall be of copper as per IS: 191-2007 (R 2016) .

6.4 Mechanical Tests on Test Bars

6.4.1 **Aluminum Bronze Test Bars:** The Test Bars for tensile and elongation tests shall be cast-to-shape type. The shape and dimensions of the test pieces shall be as shown below.



Diameter d	= 10 mm
Gauge length L_o	= 50 mm
Radius at shoulder (minimum) r	= 10 mm
Minimum parallel length (L_c)	= 55 mm

Figure-1

Three cast to shape test pieces shall be made for each lot. The Test Bars shall bear Identification mark of the lot and date of the melt. Tensile strength of the Test Bar shall not be less than 60 kgf/sq.mm and elongation shall not be less than 20%.

6.4.2 **Aluminum Alloy Test Bars:**

Three standard round test pieces, prepared as specified in Clause 6.1.4 of IS: 617-1994 (R 2016) from the same melt for which components have been cast, shall be tested for mechanical properties. The test piece shall satisfy requirement specificed in table 2 of IS 617:1994 (R 2016) (Tensile strength of the Test Bar shall not be less than 190 Mpa and elongation shall not be less than 7%).
~~Hardness test shall be carried out as per IS 1500-2005. Hardness value shall be within limit specified on the RDSO approved drawing.~~
One test piece shall be tested. If the mechanical properties are met by this test, the lot shall be deemed to have passed the tensile test. If the first test piece fails to conform to the specified requirement, the remaining two test pieces shall be tested and if either of them fails to meet the specified requirements the lot shall be rejected.

6.5 **Radiographic Examination:** All Aluminum Bronze and Aluminum Alloy castings shall meet the requirement of Specification No TI/SPC/OHE/FITTINGS/ 0130 (rev.1) or latest, when subjected to radiographic examination.

6.6 **Load test on Aluminum Bronze Fittings:** the clevis and eye (5322-1) & rope end fitting (RI no. 5341) shall be subjected to tensile load tests. The Fitting shall be assembled with the Wire Rope or Rigid Plates/Bar in a manner as approximately as possible in which it is intended to be used in service. The Assembly shall be held in a tensile testing machine. In case of Fittings assembled with Ropes, a tensile load equal to 90% of the breaking load of the Rope shall be applied and the Rope marked so as to detect any movement relative to the fittings. The load shall be maintained for one minute. There shall be no relative movement of the fitting during this period of one minute. Then the load shall be gradually increased. The fittings shall not deform, break or slip at loads less than the minimum specified breaking load of the Rope of RDSO Specification No TI/SPC/OHE/WR/1060 (Rev.1) or latest.

The Clevis and Eye, shall be tested for 5,000 kgf load applied for one minute as well as breaking load. The breaking load shall not be less than 13,500 kgf.

6.7 **Galvanizing test on forged clevis & eye, short locking plates, long locking plates, Pulley arm, tie rod, angle spacer for pulley arm & tie rod, nuts, bolts and washers:** The galvanizing of the Components, when tested as per Specification No. TI/SPC/OHE/13(4/84) or latest, shall meet the requirements of Clause No. 3.9 & 3.10 of this specification.

6.8 **Tests on Fasteners:** The fasteners used in regulating equipment shall be tested for visual examination, dimensional measurements, gauzing of threads, tensile & elongation test, head sound test, proof load test and hardness tests for there conformity to Specification No TI/SPC/OHE/ FASTNERS/0120 (rev.1) or latest.
Note: clause 6.8 is applicable for those firms which are manufacturing fasteners in house, if fasteners are purchased by the firm from RDSO approved vendors directly, and then ~~RITES Inspections certificate of fasteners shall be submitted~~ testing is not required but TC and invoice of RDSO/CORE approved Vendor is required.

6.9 **Mechanical endurance test**

i) The manufacturer, at his own cost, shall erect the test rig at his premises for endurance, Mechanical Advantage and proof load tests simulating actual working condition. The setup shall be approved by RDSO.

ii) **The test shall be conducted for 30,000 operations**. The stroke of Auto Tensioning Device during this test shall be selected in such a way that Rope is fully

wound and unwound on the Pulley. One forward and one backward motion of counterweights constitute one operation. After completion of 30,000 operations the components of the Auto Tensioning Device shall not show any appreciable wear of groove, deformation of bearings and bearing breakage, cracks or other irregularities. For this purpose, the grooves of pulley shall be examined & measured at two marked locations, at right angle to each other, before and after the endurance test.

6.10 **Test for Mechanical Advantage**: Before and after Endurance test mechanical advantage of the Auto Tensioning Device shall be checked at least 10 positions of counterweight ranging from maximum temperature position to minimum temperature position. For this purpose an accurate digital Dynamometer shall be installed and tension at different positions of the Counterweight shall be recorded. Mechanical advantage shall then be calculated as given below:

MA = Dynamometer reading/counter weight

The mechanical advantage shall not vary ± 1% from the nominal value ~~of 5~~.

6.11 **Proof Load Test**: At the end of Endurance test, the counterweight shall be doubled with respect to type of ATD and its counter weight and this load shall be maintained for 5 minutes. The Auto Tensioning Device shall be able to withstand this test successfully without any breakage or deformation of the components.

After the endurance and proof load tests have been conducted, the Equipment shall be brought down for careful examination of various components including bearing. The radii of pulleys and groove and depth of groove marked at two places before endurance test shall be measured and recorded.

7.0 **Packing and Marking**: The Auto Tensioning Devices complying with this Specification shall be packed individually. The Auto Tensioning Device's shall be properly packed, duly assembled, in strong wooden boxes so as to avoid damage during transit. The Box shall carry on its outer face the following information:

(i)	Type of ATD	(v)	Net & Gross Weight
(ii)	Manufacturer's Name	(vi)	Contract Number, Purchase Order number and Consignee
(iii)	Content Details (Number of units, Part Name, Part No. & Quantity)	(vii)	Date of Inspection
(iv)	Production Batch number	(viii)	Inspector's Stamp and Seal on the box and components

8.0 Technical literature & other details: The manufacturers shall furnish the technical details regarding the precautions to be taken while handling, procedure for fitment and removal of the bearing, storage and installation of ATD along with maintenance manual, required to be followed after installation.

9.0 "All the provisions contained in RDSO's ISO procedures laid down in document No.- D-8.1-11 Version No: 1.3 Date Effective: 01.07.2020 (Titled "Vendor- change in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor//vendors in the contracts floated by Railways to maintain quality of products supplied to Railways".

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Signature			
Designation	JE/TI	DTI-2	EDTI

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