

Government of India
Ministry of Railways
Research Designs & Standards Organisation
Manak Nagar, Lucknow - 226011

MAINTENANCE INSTRUCTION No.TI/MI/00018 Rev-3

1. **TITLE** : Auto Tensioning Device (ATD) /Regulating Equipment.
2. **APPLICATION** : Winch Type ATD.
- 3.0 **OBJECTIVE:**
 - 3.1 ATDs are meant for regulation of tension in OHE conductors & one of the important equipment, which need special attention in respect of installation as well as maintenance, as improper installation & maintenance may lead to disturbed OHE profile, resulting in poor dynamic behavior of OHE, which may, on occasion, cause panto entanglements at turnouts/cross-overs, neutral sections etc.
 - 3.2 The failure pattern of last 7 years has been thoroughly studied by RDSO & it is observed that winch type ATD has contributed to 96% failures, though its population is about 45 % on IR.
 - 3.3 Special attention needs to be given during POH as per laid down instructions, because if POH is carried out properly, certain specified checks may not be required to be carried out during other schedules and performance of ATD can be improved to a large extent.
 - 3.4 Railways having large number of failures, may like to complete the cycles of visual checks, if possible, utilizing magnifying glass without taking power block. It will help to identify the ropes with broken strands, as in certain cases, Railways have been reporting strands cutting on counter weight side.

4.0 DETAILS OF SPECIAL MAINTENANCE INSTRUCTIONS:

4.1 MONTHLY CHECKS

4.1.1 Check for **missing Balance Weights** and if found missing, panto lower/raise caution or speed restriction for passing trains (in tension lengths involving turn outs, crossovers and overlaps) should be imposed by the concerned staff.

4.1.2 Check for **free movement of ATD** by slightly pushing up or pulling down the counter weights. If obstruction in movement of counterweights is observed and the counterweight do not come back to the position from where pushed / pulled, measure the force required to move the counterweights with the help of spring balance. If the force is more than 10 kg, then take the following action:

- a) Check the parallelism of hex tie rod of antifalling device and if required, set it right.
- b) Check for bent/deformed/ missing, guide tube and deformation of eye of base counterweight and counterweight eye rod. If it is not found in order, take corrective action to remove the defects. If the equipment is completely jammed, the equipment should be dismantled and bearings should be replaced with only SKF 6305 - 2RS1 or NBC 6305-LLU.

4.2 Annual Checks:

4.2.1 Auto Tensioning Device:

- (i) Check visually whether drum of the regulating equipment is in **alignment** with the OHE. If not, then check center-to-center distance of hole of the bent arm right and bent arm left for matching each other. If the holes do not match each other, replace the defective bent arm.
- (ii) Ensure that **Clevis vertical bolt** is not over tight so as to ensure free swiveling action of drum at different temperatures.
- (iii) Check that **eye & clevis** is free to swivel. If not, file the back of clevis to obtain sufficient clearance between it and the edge of the anchor fitting without seriously affecting the strength of the fitting.

- (iv) Check the **angle spacers** over hex tie rod for free movement.
- (v) Check that the **hex pipe** of suitable length have been provided over hex tie rods as per the table given in ANNEXURE-A.

4.2.2 STAINLESS STEEL WIRE ROPES:

- (i) Check thoroughly the **condition of stainless steel wire rope** through magnifying glass, for loose wires/strands, broken wires/strands, rusting, pitting/corrosion and bird caging. If any of these defects is observed, the wire rope should be replaced immediately with new **lubricated wire rope**.
- (ii) Lubricate the wire ropes at least once in a year with "BALMEROL ROPELUBE 1000".

4.2.3 ATD & WIRE ROPE COMBINED

- (i) Check that the **stainless steel wire rope** does not over ride each other on the helical grooves of the drum. If any overriding is observed, it should be corrected manually after releasing the tension on the regulating equipment.
- (ii) Check that the **stainless steel wire rope** is centrally placed over the groove of the pulleys, if not then release the tension on ATD and manually set the wire ropes centrally on the grooves.
- (iii) Check for **rusting / corrosion /deformation /breakage of all the components**. If these are observed, then the defective components should be replaced.
- (iv) Check for looseness of fasteners and if required, tighten them
- (v) Check for appreciable **grazing of side walls of drum/wheel disc** by the wire rope carrying counter weight. If appreciable grazing of side walls of pulleys is observed, then take the following action:
 - (a) Straighten the sidewalls of drum /wheel disc by a few mild blows with wooden mallet, If found bent. If these cannot be straightened, replace the wheel disc or drum as the case may be.

- (b) Loosen or tighten the bolt connecting the bent arms to the clevis and eye and ensure that there is no grazing.
- (c) Check if the drum is tilted in vertical plane towards the bent arm right/left. If it is, then insert a beveled washer in between the clevis of eye & clevis and mast anchor fitting from bent arm right/left side, so that drum becomes vertical.
- (d) Ensure that the insertion of washer between clevis & eye and arm anchor fitting for verticality of drum does not obstruct the swiveling action.
- (e) Check for deformity of the drum/ wheel disc/pulley. If these are deformed then replace them.
- (f) Check that the **mast anchor fitting** is correctly fitted, so that its eye is in horizontal plane. If not, fit it correctly, by loosening the bolts, connecting it to mast, set the anchor fitting right and tighten the bolts. If the deformation/ manufacturing defects on the mast anchor fitting are observed, it should be replaced.
- (v) Check Z-Y dimensions and if required, adjust them according to adjustment charts as given in ANNEXURE-B.

4.3 CHECKS DURING POH

- (i) ATD should be taken out of service & dismantled carefully.
- (ii) Check the pulley, drum, bent arms & bearing housing, for any change in dimensions and if found deformed, repair/ replace, the defective part. The **bearing** should be replaced during each POH with a new bearing of NBC 6305 LLU or SKF 6305 2RS1.
- (iii) **Ovality** of SS wire rope should be checked at three places (near pulleys) 300 mm apart by measuring rope diameter at right angles. If ovality is found more than 0.51 mm, wire rope should be replaced with a new lubricated wire rope.

- (iv) Grooves of the drum should be checked with the help of **GO-NOGO gauge**. If the grooves and ridges separating the grooves have been found damaged due to overriding of the rope, the drum should be replaced.
- (v) The gap between the drum and disc should be uniform and adequate for free movement of the wire rope.
- (vi) Special care should be taken while inserting the wire rope in SS wire rope end fitting, the strands of wire rope should not be open out while reeving over the wedge piece.
- (vii) Check thoroughly the condition of stainless steel wire rope through magnifying glass for loose wires/strands, broken wires/strands, rusting, pitting/corrosion and bird caging. If any of these defects is observed, the wire rope should be replaced immediately with new lubricated wire rope.
- (viii) End reversal of wire rope should be done during each POH.

5. MAINTENANCE OF ATD RECORDS

The regulating equipment (ATD) should be checked and maintained as per the maintenance instruction. OHE depot should keep up to date, records of all ATD's in their sections, as per the format given at ANNEXURE -C.

6. AGENCY FOR IMPLEMENTATION

Railways and RE project units.

7. REFERENCE DRAWINGS AND SPECIFICATIONS :

7.0 REFERENCE DRAWINGS AND SPECIFICATIONS :

- (i) Drg. No.ETI/OHE/P/5300 Rev H - Regulating equipment (winch type)
& related part drgs. 5:1 ratio.
- (ii) Drg. No.RE/33/G/00193 - Adjustment chart of regulating equipment (winch type and pulley block type)



ANNEXURE-A**LENGTH OF PIPE ON HEX TIE ROD OF 2300 MM**

Tension lengths (m)	Length of pipe which can be provided (mm)			
	0° C	5° C	10° C	15° C
750	Nil	75	140	205
700	40	100	160	220
650	70	125	180	240
600	100	150	205	255
550	130	180	225	270
500	160	205	245	290
450	190	230	265	305
400	220	255	290	320
350	250	280	310	340
300	280	305	330	355
250	310	330	350	375
200	340	355	375	390

LENGTH OF PIPE ON HEX TIE ROD OF 2200 MM

Tension lengths (m)	Length of pipe which can be provided (mm) on hex tie rod of 2200mm length			
	0° C	5° C	10° C	15° C
750	NIL	NIL	40	105
700	NIL	NIL	60	120
650	NIL	25	80	140
600	NIL	50	105	155
550	30	80	125	170
500	60	105	145	190
450	90	130	165	205
400	120	155	190	220
350	150	180	210	240
300	180	205	230	255
250	210	230	250	275
200	240	255	275	290

ANNEXURE-B

Z = Distance between axis of movable pulley and drum

Y = Distance between bottom of counter weight and top of muff

ADJUSTMENT CHART FOR WINCH TYPE ATD																	
VALUES OF 'Z' IN mm FOR VALUE OF L IN METERS																	
T/L	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
0	1280	1310	1339	1369	1399	1429	1458	1488	1518	1548	1577	1607	1637	1667	1696	1726	1756
5	1276	1301	1327	1352	1378	1403	1429	1454	1480	1505	1531	1556	1582	1607	1633	1658	1684
10	1271	1293	1314	1335	1356	1378	1399	1420	1441	1463	1484	1505	1526	1548	1569	1590	1611
15	1267	1284	1301	1318	1335	1352	1369	1386	1403	1420	1437	1454	1471	1488	1505	1522	1539
20	1263	1276	1288	1301	1314	1327	1339	1352	1365	1378	1390	1403	1416	1429	1441	1454	1467
25	1259	1267	1276	1284	1293	1301	1310	1318	1327	1335	1344	1352	1361	1369	1378	1386	1395
30	1254	1259	1263	1267	1271	1276	1280	1284	1288	1293	1297	1301	1305	1310	1314	1318	1322
35	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
40	1246	1242	1237	1233	1229	1225	1220	1216	1212	1208	1203	1199	1195	1191	1186	1182	1178
45	1242	1233	1225	1216	1208	1199	1191	1182	1174	1165	1157	1148	1140	1131	1123	1114	1106
50	1237	1225	1212	1199	1186	1174	1161	1148	1135	1123	1110	1097	1084	1072	1059	1046	1033
55	1233	1216	1199	1182	1165	1148	1131	1114	1097	1080	1063	1046	1029	1012	995	978	961
60	1229	1208	1186	1165	1144	1123	1101	1080	1059	1038	1016	995	974	953	931	910	889
65	1225	1199	1174	1148	1123	1097	1072	1046	1021	995	970	944	919	893	868	842	817

CORRESPONDING VALUES OF 'Y' IN MILLIMETERS																	
T/L	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
0	2649	2798	2946	3095	3244	3393	3541	3690	3839	3988	4136	4285	4434	4583	4731	4880	5029
5	2628	2755	2883	3010	3138	3265	3393	3520	3648	3775	3903	4030	4158	4285	4413	4540	4668
10	2606	2713	2819	2925	3031	3138	3244	3350	3456	3563	3669	3775	3881	3988	4094	4200	4306
15	2585	2670	2755	2840	2925	3010	3095	3180	3265	3350	3435	3520	3605	3690	3775	3860	3945
20	2564	2628	2691	2755	2819	2883	2946	3010	3074	3138	3201	3265	3329	3393	3456	3520	3584
25	2543	2585	2628	2670	2713	2755	2798	2840	2883	2925	2968	3010	3053	3095	3138	3180	3223
30	2521	2543	2564	2585	2606	2628	2649	2670	2691	2713	2734	2755	2776	2798	2819	2840	2861
35	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
40	2479	2458	2436	2415	2394	2373	2351	2330	2309	2288	2266	2245	2224	2203	2181	2160	2139
45	2458	2415	2373	2330	2288	2245	2203	2160	2118	2075	2033	1990	1948	1905	1863	1820	1778
50	2436	2373	2309	2245	2181	2118	2054	1990	1926	1863	1799	1735	1671	1608	1544	1480	1416
55	2415	2330	2245	2160	2075	1990	1905	1820	1735	1650	1565	1480	1395	1310	1225	1140	1055
60	2394	2288	2181	2075	1969	1863	1756	1650	1544	1438	1331	1225	1119	1013	906	800	694
65	2373	2245	2118	1990	1863	1735	1608	1480	1353	1225	1098	970	843	715	588	460	333

5:1 RATIO, WINCH TYPE ATD

FORMAT FOR RECORDING THE OBSERVATIONS/MEASUREMENTS

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RAILWAY :-----

DATE OF INSPECTION:---

DIVISION :-----

SECTION :-----

LOCATION:-----

SN	Item	Details of item	Checks	Observation	Remedial action taken	Details of replacement, if any	Previous inspection (Routine/AOH/I OH/POH) dates with record no.	Remark
1.	Drum and wheel disc	Manufacturer: Date of installation:	(i) Visual examination of wear of drum with Go, Nogo gauge & Wheel disc (ii) Visual examination of wear of bent arms on both side (iii) Grazing of side walls of drum/wheel disc with wire rope (iv) Alignment of drum with OHE (v) Gap between drum and wheel disc					

SN	Item	Details of item	Checks	Observation	Remedial action taken	Details of replacement, if any	Previous inspection (Routine/AOH/IOH/POH) dates with record no.	Remark
2.	Pulley	Manufacturer: Date of installation:	(i) Visual examination of wear of pulley, bent arms (ii) Movement of axle (iii) Grazing of side walls of pulley with wire rope (iv) Alignment of pulley block of ATD with OHE and bent arms					
3.	S. S. Wire rope	Manufacturer: Year of manufacturer: Date of installation: Specification to which procured:	(i) Condition of SS wire rope (ii) Position of SS wire rope over pulley groove (iii) Date of lubrication (iv) Measurement of X, Y dimensions as per adjustment chart of ATD (v) Status of inner and outer strands of wires (vi) Ovality of SSWR over radically moving portion of rope.					

SN	Item	Details of item	Checks	Observation	Remedial action taken	Details of replacement if any	Previous inspection (Routine/AOH/IO H/POH) dates with record no.	Remark
4.	Bearing	Bearing No.: Manufacturer: Date of installation:	(i) Condition of felt and grease seal					
5.	Clevis & Eye	Type(Al Bz or forged steel): Manufacturer:	(i) Visual examination (ii) Alignment of clevis with fixed pulley (iii) Movement of clevis & eye					
6.	Hex tie rod	Make: Date of installation:	(i) Visual examination for rusting/corrosion/deformation/break age (ii) Parallelism of hex tie rod (iii) Length of hex tie rod (iv) Movement of angle spacer of hex tie rod					
7.	Counter weights	Make: Date of installation:	(i) Check for missing counter weights (ii) Check deformation of eye of the base CW					

SN	Item	Details of item	Checks	Observation	Remedial action taken	Details of replacement if any	Previous inspection (Routine/AOH/IOH/POH) dates with record no.	Remark
8.	Mast anchor fitting	Manufacturer Date of installation Type	(i) Check deformation of fitting (ii) Check whether eye of fitting is in horizontal plane.					
9.	Guide Tube		(i) Check for bent/deformed/missing guide tube					
10.	Fastners		(i) Looseness of fasteners					