

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

MAINTENANCE INSTRUCTION No.TI/MI/00029 Rev-3

1. **TITLE** : Auto Tensioning Device (ATD) /Regulating Equipment.
2. **APPLICATION** : 3:1 Ratio three pulley 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 section etc.
 - 3.2 The failure pattern of last 7 years has been thoroughly studied by RDSO & it is observed that most of the failures of SS wire rope are with winch type ATD. Failures of 3 pulley ATDs have also been reported 2003-04 onwards, even though it has contributed only 4% to failures, with population of 45 % on IR. RDSO has reframed the maintenance instruction for 3-pulley type ATDs, clearly indicating action to be taken during monthly & annual checks and POH of ATDs, so as to arrest failures of stainless steel wire ropes and ATD.
 - 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. 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 deformation of counterweight eye rod, 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 all the **pulleys** are in same vertical plane, pulley block of the ATD is in alignment with the OHE and the bent arms of the pulley block are parallel to the pulley. If not, then check, center to center distance of holes of the bent arms of pulley/pulley block. If the holes do not match with each other, replace bent arms.
- (ii) 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.
- (iii) Check the **angle spacers** over hex tie rod are free to move.

- (iv) 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** 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.
- (iii) Check for appreciable grazing of side walls of pulleys, by the wire rope . If appreciable grazing of side walls of pulleys is observed, then take the following action:
- (a) Straighten the side walls of pulley by a few mild blows with wooden mallet. If these can not be straightened, replace the pulley/pulleys.
- (b) Loosen or tighten the bolt connecting the bent arms to the clevis & eye to ensure that there is no grazing between & the section of wire rope carrying counterweight.
- (c) 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.
- (d) Check if the pulley 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 pulley becomes vertical.

(iv) Check **X-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, bent arms & bearing housing for any change in dimension and if found deformed, it should be repaired/ replaced. 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) 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.
- (v) 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**.
- (vi) End reversal of wire rope should be done during alternate 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 :

- (i) Drg. No.ETI/OHE/P/5500-1 Rev K - Regulating equipment (3-pulley type)
Sheet-1of 2 3:1 ratio.
- (ii) Drg. No.ETI/OHE/P/5500-1 Rev.C - Part details of regulating equipment
Sheet-2 of 2 (3 : 1 ratio)
- (iii) Drg. No. ETI/OHE/G/00195 - Adjustment chart of regulating
equipment three pulley type
- (vi) Drg. No.TI/DRG/OHE/ATD/RDSO/ - Regulating equipment (three pulley type)
00001/99/1 3:1 ratio (modified).
- (v) Drg. No. TI/DRG/OHE/ATD/RDSO/ - Part details of regulating equipment
00002/99/1 3 : 1 ratio (Modified)
- (vi) Drg No. TI/DRG/OHE/ATD/RDSO/ - Adjustment chart of regulating equip.
00003/99/0 three pulley type (3:1 ratio) Modified.
- (viii) Drg No. TI/DRG/OHE/ATD/RDSO/ - Drawing of M-18 X 75/32 bolt with
00008/05/0 castle nut.



ANNEXURE-A**THREE PULLEY TYPE ATD (3:1 RATIO)-OLD**

Tension lengths(m)	Length of pipe which can be provided (mm)			
	0° C	5° C	10° C	15° C
750	85	150	215	280
700	115	175	235	295
650	145	200	255	310
600	175	225	275	330
550	205	250	300	345
500	235	280	320	360
450	265	305	340	380
400	295	330	360	395
350	325	355	385	420
300	355	380	405	430
250	385	405	425	450
200	415	430	450	465

THREE PULLEY TYPE ATD (3:1 RATIO)-MODIFIED

Tension lengths(m)	Length of pipe which can be provided (mm)			
	0° C	5° C	10° C	15° C
750	95	155	220	285
700	125	185	240	300
650	155	210	265	320
600	185	235	285	335
550	215	260	305	355
500	240	285	330	370
450	270	310	350	385
400	300	335	370	405
350	330	360	390	420
300	360	385	410	440
250	390	410	435	455
200	420	440	455	470

X = Distance between axis of movable pulley and fixed pulley

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

ADJUSTMENT CHART FOR 3 PULLEY ATD(OLD)																
VALUES OF 'X' 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
0	1080	1110	1139	1169	1199	1229	1258	1288	1318	1348	1377	1407	1437	1467	1496	1526
5	1076	1101	1127	1152	1178	1203	1229	1254	1280	1305	1331	1356	1382	1407	1433	1458
10	1071	1093	1114	1135	1156	1178	1199	1220	1241	1263	1284	1305	1326	1348	1369	1390
15	1067	1084	1101	1118	1135	1152	1169	1186	1203	1220	1237	1254	1271	1288	1305	1322
20	1063	1076	1088	1101	1114	1127	1139	1152	1165	1178	1190	1203	1216	1229	1241	1254
25	1059	1067	1076	1084	1093	1101	1110	1118	1127	1135	1144	1152	1161	1169	1178	1186
30	1054	1059	1063	1067	1071	1076	1080	1084	1088	1093	1097	1101	1105	1110	1114	1118
35	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
40	1046	1042	1037	1033	1029	1025	1020	1016	1012	1008	1003	999	995	991	986	982
45	1042	1033	1025	1016	1008	999	991	982	974	965	957	948	940	931	923	914
50	1037	1025	1012	999	986	974	961	948	935	923	910	897	884	872	859	846
55	1033	1016	999	982	965	948	931	914	897	880	863	846	829	812	795	778
60	1029	1008	986	965	944	923	901	880	859	838	816	795	774	753	731	710
65	1025	999	974	948	923	897	872	846	821	795	770	744	719	693	668	642

CORRESPONDING VALUES OF 'Y' IN MILLIMETERS																
T/L	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
0	2389	2479	2568	2657	2746	2836	2925	3014	3103	3193	3282	3371	3460	3550	3639	3728
5	2377	2453	2530	2606	2683	2759	2836	2912	2989	3065	3142	3218	3295	3371	3448	3524
10	2364	2428	2491	2555	2619	2683	2746	2810	2874	2938	3001	3065	3129	3193	3256	3320
15	2351	2402	2453	2504	2555	2606	2657	2708	2759	2810	2861	2912	2963	3014	3065	3116
20	2338	2377	2415	2453	2491	2530	2568	2606	2644	2683	2721	2759	2797	2836	2874	2912
25	2326	2351	2377	2402	2428	2453	2479	2504	2530	2555	2581	2606	2632	2657	2683	2708
30	2313	2326	2338	2351	2364	2377	2389	2402	2415	2428	2440	2453	2466	2479	2491	2504
35	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
40	2287	2275	2262	2249	2236	2224	2211	2198	2185	2173	2160	2147	2134	2122	2109	2096
45	2275	2249	2224	2198	2173	2147	2122	2096	2071	2045	2020	1994	1969	1943	1918	1892
50	2262	2224	2185	2147	2109	2071	2032	1994	1956	1918	1879	1841	1803	1765	1726	1688
55	2249	2198	2147	2096	2045	1994	1943	1892	1841	1790	1739	1688	1637	1586	1535	1484
60	2236	2173	2109	2045	1981	1918	1854	1790	1726	1663	1599	1535	1471	1408	1344	1280
65	2224	2147	2071	1994	1918	1841	1765	1688	1612	1535	1459	1382	1306	1229	1153	1076

ADJUSTMENT CHART FOR 3 PULLEY ATD(modified)																
VALUES OF 'X' 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
0	1330	1360	1389	1419	1449	1479	1508	1538	1568	1598	1627	1657	1687	1717	1746	1776
5	1326	1351	1377	1402	1428	1453	1479	1504	1530	1555	1581	1606	1632	1657	1683	1708
10	1321	1343	1364	1385	1406	1428	1449	1470	1491	1513	1534	1555	1576	1598	1619	1640
15	1317	1334	1351	1368	1385	1402	1419	1436	1453	1470	1487	1504	1521	1538	1555	1572
20	1313	1326	1338	1351	1364	1377	1389	1402	1415	1428	1440	1453	1466	1479	1491	1504
25	1309	1317	1326	1334	1343	1351	1360	1368	1377	1385	1394	1402	1411	1419	1428	1436
30	1304	1309	1313	1317	1321	1326	1330	1334	1338	1343	1347	1351	1355	1360	1364	1368
35	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
40	1296	1292	1287	1283	1279	1275	1270	1266	1262	1258	1253	1249	1245	1241	1236	1232
45	1292	1283	1275	1266	1258	1249	1241	1232	1224	1215	1207	1198	1190	1181	1173	1164
50	1287	1275	1262	1249	1236	1224	1211	1198	1185	1173	1160	1147	1134	1122	1109	1096
55	1283	1266	1249	1232	1215	1198	1181	1164	1147	1130	1113	1096	1079	1062	1045	1028
60	1279	1258	1236	1215	1194	1173	1151	1130	1109	1088	1066	1045	1024	1003	981	960
65	1275	1249	1224	1198	1173	1147	1122	1096	1071	1045	1020	994	969	943	918	892

CORRESPONDING VALUES OF 'Y' IN MILLIMETERS																
T/L	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
0	2389	2479	2568	2657	2746	2836	2925	3014	3103	3193	3282	3371	3460	3550	3639	3728
5	2377	2453	2530	2606	2683	2759	2836	2912	2989	3065	3142	3218	3295	3371	3448	3524
10	2364	2428	2491	2555	2619	2683	2746	2810	2874	2938	3001	3065	3129	3193	3256	3320
15	2351	2402	2453	2504	2555	2606	2657	2708	2759	2810	2861	2912	2963	3014	3065	3116
20	2338	2377	2415	2453	2491	2530	2568	2606	2644	2683	2721	2759	2797	2836	2874	2912
25	2326	2351	2377	2402	2428	2453	2479	2504	2530	2555	2581	2606	2632	2657	2683	2708
30	2313	2326	2338	2351	2364	2377	2389	2402	2415	2428	2440	2453	2466	2479	2491	2504
35	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
40	2287	2275	2262	2249	2236	2224	2211	2198	2185	2173	2160	2147	2134	2122	2109	2096
45	2275	2249	2224	2198	2173	2147	2122	2096	2071	2045	2020	1994	1969	1943	1918	1892
50	2262	2224	2185	2147	2109	2071	2032	1994	1956	1918	1879	1841	1803	1765	1726	1688
55	2249	2198	2147	2096	2045	1994	1943	1892	1841	1790	1739	1688	1637	1586	1535	1484
60	2236	2173	2109	2045	1981	1918	1854	1790	1726	1663	1599	1535	1471	1408	1344	1280
65	2224	2147	2071	1994	1918	1841	1765	1688	1612	1535	1459	1382	1306	1229	1153	1076

3:1 RATIO, THREE PULLEY 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/IO H/POH) dates with record no.	Remark
1.	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					
2.	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 the 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
3.	Bearing	Bearing No.: Manufacturer: Date of installation:	(i) Condition of felt and grease seal					
4.	Clevis & Eye	Type(Al Bz or forged steel): Manufacturer: Date of Installation:	(i) Visual examination (ii) Alignment of clevis with fixed pulley (iii) Movement of clevis & eye					
5.	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					
6.	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
7.	Mast anchor fitting	Manufacturer Date of installation Type	(i) Check deformation of fitting (ii) Check whether eye of fitting is in horizontal plane.					
8.	Guide Tube		(i) Check for bent/deformed/missing guide tube					
9.	Fastners		(i) Looseness of fasteners					

