



सत्यमेव जयते

भारतसरकार **GOVERNMENT OF INDIA**
रेलमंत्रालय **MINISTRY OF RAILWAYS**

सं.टीआई/एसपीसी/ओएचई/टूलपीएल/0991

No. TI/SPC/OHE/TOOLPL/0991

(सितम्बर 2021/September ,2021)

गियरलेसहैंडऑपरेटेडपुलिंगऔरउठानेकीमशीनेंकेलिएतकनीकीविशिष्टी

**TECHNICAL SPECIFICATION FOR
GEARLESS HAND OPERATED PULLING AND LIFTING MACHINES
[TIRFOR]**

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MANAK NAGAR, LUCKNOW-226011**

**TECHNICAL SPECIFICATION NO. TI/SPC/OHE/TOOLPL/0991
FORGEARLESS HAND OPERATED PULLING AND LIFTING MACHINES
[TIRFOR]**

1. Scope:

1.1. This specification covers the requirements of “Gearless Hand Operated Pulling and Lifting Machines herein called as the ‘TIRFOR’ of 0.8 t, 1.6 t and 3.2 t capacities to be used in conjunction with the wire rope conforming to IS:2266-2019 or latest for maintenance of traction overhead lines. This specification revised to update standard, to incorporate A&C slip.

2. Service Conditions:

2.1. The TIRFOR along with its associated fittings/components is intended to be used outdoor throughout India including marine/industrially polluted areas under atmospheric conditions prevailing in India. The TIRFOR and its associated fittings/components may be subjected to rough handling during the course of maintenance of overhead traction lines and during transportation.

2.2. The “Make in India” policy of Government of India shall be applicable.

3. Governing specification:

3.1. The TIRFOR shall generally conform to IS:5604-1984 (Reaffirmed year:2020) or latest which is hereinafter referred to as the “Governing specification”. The provisions of the governing specification shall be applied in the manner altered, amended or supplemented by this specification.

4. Deviations from specification:

4.1. Any deviation from this specification calculated to improve the performance, utility and efficiency of the equipment, proposed by firm/manufacturer will be given due consideration provided full particulars with justification thereof are furnished.

5. Workmanship and construction:

5.1. General-The TIRFOR shall be as light in weight as possible and shall be robust in construction, without gears, pawls or ratchets and shall be designed on draw vise principle in which lifting/pulling or lowering of the load is accomplished by two pairs of forged steel jaws controlled by a lever. The wire rope shall pass through the unit itself and not reeled on a drum. The grip on the wire rope shall be self energizing in which the weight of the load actuates the jaws. The wire rope at all times shall be held by one pair of jaws while the other

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pair having been opened by cams, shall be moved by lever for next gripping or pulling motion.

The TIRFOR shall be so constructed that the movement is controlled in either direction without jerking or snatching. The arrangement shall be such that it is possible to draw the unlimited length of wire rope through the cable. The machine shall be provided with forged steel anchoring hook at one end and the forged steel cable hook slinged with wire rope at the other end. "As an alternate Dee shackle with pin slinged to wire rope at load end may be provided if required by the purchaser" Suitable length of galvanised steel wire rope as required by the purchaser shall also be supplied alongwith the TIRFOR.

The manufacturer shall obtain the length of wire rope required from the purchaser. The wire rope shall be procured from reputed manufacturers.

Permissible back slippage of the load as a percentage of total lift in one stroke (forward and backward) shall be as follows:

Lifting capacity of Machine (t)	Load applied (t)	Permissible back slip (percentage)
0.8	0.8	10
1.6	1.6	10
3.2	3.2	15

5.2. Machine- The housing of TIRFOR shall be either cast or fabricated for proper strength and shall be robust in construction and shall maintain alignment under all expected conditions of service . if of fabricated construction, it shall be stress relieved before machining and assembly. All parts of machine shall be constructed with a minimum factor of safety of 5.

5.3. Blocks – Blocks and all components shall have adequate strength to withstand the working load.

5.4. Bearings – The crank shall be provided with suitable roller bearings or bearing bushes. The bearing bushes should be of anti-friction type or of suitable non-ferrous material."Ball and parallel roller bearings shall comply with the requirements of IS:5669-2019 or latest and IS:5692-2019 or latest with the provision that needle roller bearing are permitted or may, alternatively, be of the self lubricated type conforming to IS:3980-1982(Reaffirmed Year:2020) or latest". The bearing surfaces shall be smoothly finished.

5.5. Heat treatment – All components before machining shall be normalised or hardened and tempered.

5.6. All components shall be treated for rust prevention.

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6. Material:

6.1. Details are tabulated below:

Material Description	Applicable Standards
Plates and bars- Structural steel	IS:2062-2011 (Reaffirmed year:2016) or latest Gr.A
Hooks & Other such items	Forged steel to IS:2004-1991 (Reaffirmed year:2018) or latest Class 2
Aluminium alloy	IS: 617-1994 (Reaffirmed Year : 2020)or latest Grade 4600 M or latest
Cold drawn steel wire for coil spring	Table 1 of IS:4454(Pt.I)2001(Reaffirmed Year : 2015) or latest
Tin Bronze	IS:306-1983 (Reaffirmed Year : 2021) or latest.
Phosphor Bronze Rods and Bars	IS: 7811 -2019 or latest
Dee Shackles	IS:6132-2003 (Reaffirmed Year : 2008) or latest
Hooks	IS: 2759 -2002 (Reaffirmed Year : 2017) or latest and IS:8610 -1977 (Reaffirmed Year : 1991) or latest
Galvanised steel wire ropes Suitable for the application	6 x 19 construction upto 12mm diameter and 6 x 36 or 6 x 37 construction above 12mm diameter, tensile grade 1770 Min, IWRC (Independent Wire Rope Core) to IS: 2266-2019 or latest. The zinc coating shall conform to "Heavy coating" as laid down in IS: 4826:1979 (Reaffirmed Year : 2021) or latest

6.1.1. The jaws shall be made from the alloy steel containing at least 0.90 percent chromium to ensure resistance to abrasion. The alloy steel after suitable heat treatment (hardening & tempering) shall have the following properties.

Properties	Value
Tensile strength,	Min.900 MN/m ²
Elongation (at gauge length $5.65\sqrt{A}$)	Min 15 Percent
Izod impact value	40 Nm
Hardness	Min 300 BHN

6.1.2. For quality & material of parts used, the manufacturer shall produce adequate evidence including test certificates that such parts/components have been used strictly conforming to the requirements. Such test certificates shall be included in the test report.

7. Tolerances:

7.1. Tolerances on forgings – Tolerances on forgings shall conform to the requirements of IS: 3469 – 1974(Reaffirmed Year : 2018) or latest.

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7.2. Machining tolerances – Machining tolerances shall conform to medium class of IS: 2102 - 1993(Reaffirmed Year : 2019) or latest.

8. Weight:

8.1. The machine shall be portable and the weight shall, therefore, be such that the machine can be lifted and carried easily by twopersons.

9. Effort:

9.1. The manufacturer shall specify the operating effort on the handle required to raise the safe working load and also the velocity of wire rope in mm/stroke.

10. Freedom from defects:

10.1. All Parts of the machine shall be free from casting/manufacturing defects and other irregularities. No repairs shall be done to the castings and other components to hide their defects.

11. Supply

11.1. The TIRFOR shall be supplied complete in all respects including wire rope and operating lever of sufficient length to facilitate application of required force. The manufacturer shall obtain the following information from the purchaser before manufacture of TIRFOR.

- a) Load to be lifted and to be dragged,
- b) Type of load and
- c) Length of wire rope used in the process.

12. Inspection certificate of test and examination:

12.1. The representative of the purchaser shall have access to the works of manufacturer at all reasonable times for the purpose of witnessing the method of manufacture, specified tests, inspecting the testing equipment and methods of examination.

12.2. Certificate of test and examination- A certificate of test and examination shall be issued with every consignment of TIRFOR, giving the following information for each one:

- a) Distinguishing mark,
- b) Description,
- c) Back slippage of load per stroke,
- d) Wire rope construction, size and grade,
- e) Number tested,
- f) Proof load applied,
- g) Operational test load applied,

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- h) Rating and
- i) Month and year of manufacture.

13. Packing and Marking:

13.1. The TIRFOR shall be properly packed duly assembled in strong wooden boxes so as to avoid damage during transit. One box shall contain not more than two assemblies.

13.2. The following details shall be permanently and legibly marked on a suitable part or name plate provided on each TIRFOR giving the following information:

- a) Manufacturer's name and trade mark,
- b) Safe working load,
- c) Maximum diameter of wire rope for which to be used,
- d) Rating and
- e) Month and year of manufacture

13.3. Every packing shall carry in legible and indelible lettering the following information:

- a) Type of machine packed,
- b) Number of machines packed,
- c) Production batch number,
- d) Manufacturer's name brand or trade mark,
- e) Net and gross weight,
- f) Contract number/purchase order number and consignee,
- g) Date of inspection and
- h) Any other particulars which the manufacturer wants to specify.

14. Tests:

14.1. All the tests specified in this specification shall be carried out at the manufacturer's works and shall be arranged without making any claim or charges for such tests including labour, machinery/apparatus etc. However, such tests, for which the facility is not available with the manufacturer, may be conducted with reputed testing agencies after specific approval of purchaser. All such tests shall be witnessed by the representative of RDSO/Purchaser. The cost of samples or components destructed during type testing shall be borne by the manufacturer.

14.2. Test certificates for the physical and chemical properties of the raw material and that for hooks and wire ropes for their conformity to the specifications stipulated/relevant specifications shall be obtained by the manufacturer from the suppliers of material procured/processed. The test certificates shall be produced at the time of inspection. The manufacturer shall also check the chemical composition of every lot of raw material

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purchased and produced. The certificate of these tests shall be produced at the time of inspection.

14.3. The representative of the RDSO/Purchaser shall be at liberty to test any or all the components of the 'TIRFOR' to check their conformity to the specifications laid down.

14.4. Before giving call to RDSO/Purchaser for inspection and testing of prototype, the manufacturer shall submit a detailed test schedule consisting of the details of each test, nature of the test, venue of the test, duration of each test and total number of days required to complete the tests at one stretch. Once the test schedule is approved the tests shall invariably be done accordingly.

14.5. However, during the process of type testing 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 to his satisfaction or for gaining additional information and knowledge.

14.6. In case, any dispute or disagreement arises between the manufacturer and RDSO/Purchaser's representative during the process of testing as regard to type test and for the interpretation and acceptability of the type test results, it shall be brought to the notice of Director General (Traction Installation), Research Designs and Standards Organisation, ManakNagar, Lucknow whose decision shall be final and binding.

15. Submission of data drawings and particulars:

15.1. The manufacturer shall submit the detailed literature on handling operation and maintenance of machine.

15.2. The manufacturer shall submit for scrutiny and approval, the following drawings in triplicate in size of 210 mm x 297 mm or multiples thereof.

15.2.1. Drawing showing the assembly of machine (plan, elevation and cross section) including a table indicating the description of item, material specification with grade and quantity of components used in the assembly.

15.2.2. Individual assembly of parts wherever applicable.

15.2.3. Detailed dimensioned drawings of each part and component.

15.3. After all the drawings are approved, the manufacturer shall submit three reproducible tracing films for each drawings for signature of approving authority.

15.4. Only after all the design and drawings have been approved and clearance given by RDSO/Purchaser to this effect, the manufacturer shall take up manufacture of the prototype for RDSO/Purchaser's inspection. It is to be clearly understood that any changes required to be done in the prototype as required by RDSO/Purchaser shall be done expeditiously.

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16. Type tests:

16.1. Type tests shall be carried out to demonstrate the suitability of design, materials and method of construction and the capability of manufacturer to produce the TIRFOR in accordance with the specification.

16.2. The manufacturer shall produce at least three prototype samples for conducting following type tests:

- a) Visual examination,
- b) Measurement of dimensions,
- c) Measurement of weight,
- d) Proof loading, and
- e) Operational test

The tests listed from (a) to (c) above shall be conducted on three samples of each type of TIRFOR. The tests listed at (d) and (e) shall be conducted on one sample.

17. Acceptance tests:

17.1. All the tests listed in Clause 16.2 shall constitute acceptance tests.

17.2. Inspection and sampling procedure

17.2.1. The TIRFOR shall be offered in lot of not more than 25 numbers, the components essentially belonging to the same melt/batch and manufactured from same raw material. There assemblies shall be selected at random from every lot after it has been subjected to routine tests by the manufacturer. The assemblies so selected shall be subjected to the tests specified in Clause 17. Only one assembly shall be subjected to proof loading and operational test. Rest of the assemblies in a lot shall be subjected to operational test. Only such assemblies which fail in operational test shall be rejected.

18. Criteria for acceptance:

18.1. The assemblies selected shall pass the specified tests otherwise the lot shall be rejected. If failure occurs in proof loading and operational test of assembly selected, two numbers of other assemblies from the same lot shall be selected and subjected to these tests. Lot shall be accepted if there is no failure in re-test.

18.2. Inspector shall affix an indelible stamp, punch mark or 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.

19. Routine tests:

19.1. The following tests shall be carried out by the manufacturer and records maintained:

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- a) Visual examination,
- b) Measurement of dimensions, and
- c) Measurement of weight.

20. Methods of Tests

- 20.1. Visual Examination – The components/parts of the TIRFOR shall be visually examined for any manufacturing defect, deformation of parts, misalignment, rusting, pitting/corrosion etc. No such defects which may be harmful to safe/satisfactory operation of TIRFOR shall be acceptable. The marking shall also be seen on each TIRFOR for the provision of required details.
- 20.2. Measurement of dimensions: The major and other critical dimensions of the machine shall conform to the drawings approved by the RDSO/Purchaser.
- 20.3. Measurement of weight: The weight of each type of machine shall be measured and shall be as per approved drawings.
- 20.4. Proof loading- The ‘trifor’ shall be tested prior to operational test with a static load of twice the safe working load of which it shall withstand for at least two minutes without permanent deformation of any component.
- 20.5. Operational test – After proof loading the lifting and pulling machine shall be made to lift 1.5 times the safe working load through a distance of 30 cm in such a manner as to ensure that every part of mechanism comes under load. During the test, there shall be no deformation of any component part.
- 20.6. Examination- After proof loading and the operational test, the TIRFOR shall be thoroughly examined for freedom from deformation, cracks, flaws or other defects on the components. It will be treated to comply with this standard only if it is found free from deformation, cracks, flaws or other defects.

21. Guarantee/Warranty:

- 21.1. Guarantee/Warranty shall be as per Indian Railways Standard Conditions of Contract.
22. All the provisions contained in RDSO’s ISO procedures laid down in document No.- QQ-D-8.1-11 version 1.7 dated 22.01.2021 or latest 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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