

NEW ZEALAND GOVERNMENT RAILWAYS	HIGH TENSILE STEEL CASTINGS FOR TRANSITION HEADS DRAWING NO. 28148	CODE No. 91, Part B	
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(1) GENERAL:

All high tensile steel castings for drawgear transition heads shall comply with the following chemical composition and physical properties unless drawings indicate otherwise or special instructions are issued for an alternative composition, from the Chief Mechanical Engineer.

(2) CHEMICAL COMPOSITION:

Made to B.S. 3100 : 1976 B.T. 2		(Percent)
Carbon		0.26 - 0.31
Silicon	Max	0.50
Manganese		0.5 - 0.8
Nickel		1.8 - 2.1
Chromium		0.6 - 0.9
Molybdenum		0.25 - 0.45
Sulphur	Max	0.040
Phosphorous	Max	0.040

Note:—

B.T. 2 is a physical property specification primarily and only phosphorus and sulphur are mandatory. Minor variation but only by the Foundry Metallurgist.

(3) PHYSICAL PROPERTIES: (B.S. 3100: 1976 BT2)

Ultimate tensile strength	N/ mm ²	Min	850
Lower Yield stress or 0.2% proof stress	N/mm ²	Min	585
Elongation	%	Min	8
Charpy V-notch impact value	(j)	Min	25

The physical properties test shall be carried out in accordance with British Standards (B.S. 18 Part (2) + BS 131 part (2)) or (ISO 82 + ISO 148).

The test samples shall be cast attached to a casting whenever practicable and shall receive the same heat treatment as the parent casting. One test shall be made from each melt. Works Managers are to arrange for expeditious handling of test pieces so that the results will be available within four days of the completion of heat treatment.

(4) CASTING:

- Transition head castings must be left to cool in the mould after casting and must not under any circumstances be "knocked out" hot.
- "Knock off" runners and risers may be used on the casting to obviate the need for gas cutting.
- After the castings have been "knocked out" of the sand mould they are to be shot blasted and the runners and risers "knocked off" they are then to be fully annealed before any further fettling process is carried out upon them. Grinding, gas cutting or welding on an "as cast" casting in this type of steel can cause cracking.

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(5) HEAT TREATMENT:

Heat treatment for this high tensile steel comprises an annealing or normalising process followed by quenching and tempering as follows:—

New Castings or transition heads repaired by welding		Transition Head requiring forging or press operations	
(a)	Austenitize or soak at 860 / 870 ⁰ C for 2 hours.	(i)	Austenitize or soak at 860 / 870 ⁰ C for 2 hours.
(b)	* Quench in an approved quenching oil. Quenching oil is to be maintained between 35 - 60 ⁰ C.	(ii)	Complete all forging before temperature drops to 820 ⁰ C. If forging is not complete, repeat procedure (i) and then finish forging.
(c)	Temper by reheating to 575 / 600 ⁰ C and hold for 2 hours.	(iii)	After forging is completed return to furnace and re-soak at 860 / 870 ⁰ C for 2 hours.
Note: Quenched castings are to be placed in a cold furnace and raised gradually to the tempering temperature.		(iv)	Quench in oil. Oil to be maintained between 35-60 ⁰ C.
(d)	After tempering allow to cool in air. * Approved quenching oils:	(v)	Temper by reheating to 575 / 600 ⁰ C and soak for 2 hours.
(i)	Houghton's quenching oil.	(vi)	After tempering allow to cool in air.
(ii)	Castrol ILO-quench S100.		

NOTE:-

After heat treatment transition heads should be crack tested by the fluorescent magnetic particle test method. Radiographs may be taken on selected castings as requested by the Chief Mechanical Engineer.

(6) REPAIR WELDING:

This steel is difficult to weld owing to its "hardenability".

Welding on this alloy should be approached with extreme caution and carried out strictly in accordance with the following instructions. Unless proper care is taken a brittle zone adjacent to the weld will develop possibly resulting in weld or under bead cracking.

The approved electrode is Alloycraft 11018G a low hydrogen, high tensile, all position electrode held in stock in most branches of New Zealand Industrial Gases Limited.

The weld procedure must include preheating to 250⁰ C and immediate post heating to 600⁰ C to avoid cracking. After completion of welding, to remove stresses set up during welding and to re-gain the required physical properties, the transition heads must be heat treated as in part 5, steps (a) to (d).

(7) RECORDS:

Each cast is to be allocated a serial number. A book is to be kept by the Foundry Metallurgist giving the cast number, date, the physical properties of the test piece and the number of transition heads cast, per melt.