



Appendix 7

Quality and Operations Assessment Schedule for High Strength Steel Tendons for the Pre-tensioning or Post-tensioning of Concrete Including Inspection and Testing Requirements

1. Scope

1.1 This Schedule describes the minimum quality and operational control requirements for the manufacture of high strength steel tendons conforming to the requirements of AS/NZS 4672 Parts 1 and 2 for the pre-tensioning or post-tensioning of concrete, and is additional to the quality management, operational and general requirements contained in Appendix 1. Unless otherwise stated, where reference is made in this Appendix to "AS4672", the relevant provisions of both Parts 1 and 2 shall apply.

1.2 This Schedule covers the manufacture of:

- As-drawn (mill coil) wire;
- Stress-relieved wire;
- Quenched and tempered wire
- Strand;
- Hot-rolled bars, with or without subsequent processing,

commencing with the supply of raw materials from ACRS certified or approved sources.

2. Steel Supply

Where the Firm manufactures finished steel of the required specification in-house, the requirements of Appendix 1 shall apply, together with the quality and operational control requirements of Appendix 2 (for the manufacture of bars) and Appendix 4 (for the manufacture of wire) and further requirements as detailed in this Appendix.

Where semi-finished steel of the required specification is sourced from external suppliers, the requirements of Appendices 1, 2 and/or 4 as appropriate shall apply for the manufacture of this feed product. Where deemed by ACRS to be necessary, conformance to the requirements of each applicable Appendix shall be assessed separately and may require separate Certification.

In addition to the above, there shall be adequate control, measurement and inspection procedures that ensure feed materials have suitable microstructures (excluding billet product), steel cleanliness and freedom from harmful segregation consistent with achieving the required process capability, properties and quality.

3. Processing

There shall be documented procedures for the operation and control of required cold stretching, wiredrawing, stranding, stressing and heat treatment operations that ensure consistency of product, and that the finished product conforms to the relevant

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specification and customer requirements. These shall include, as a minimum requirement:

1. The control of dimension and shape properties including size, lay length and surface profile, as appropriate.
2. The control of mechanical properties as required by the Standard, and customer special requirements.

4. Testing and Inspection

There shall be documented procedures for the physical inspection and dimensional checking of each batch of finished product.

There shall be documented procedures for the sampling and testing of finished product to verify that the mechanical properties conform to specification and customer requirements.

An initial application for Certification requires a minimum of six coils manufactured at least two weeks apart from any other coil to be tested and reported for each production line. A copy of the Firm's test certificate for each coil, together with the actual relaxation test data shall be supplied to ACRS with the application.

The Initial Assessment shall undertake independent verification testing of samples from at least two of the coils for which data has been submitted in the Firm's application.

(Note: It is essential that the Firm provide data for coils identical to those that are the subject of ACRS independent verification testing)

A suitably qualified and experienced person (e.g. metallurgist or engineer) shall be involved in the quality control of the process and responsible for all testing and inspection. This person shall review all test samples and results for conformance to the requirements of the Scheme and ensure the process remains conforming. This person will be the primary point of contact for the ACRS assessor.

5. Traceability

The heat or batch identity shall be maintained on all feedstock awaiting initial processing. It shall be possible to cross-reference all feedstock with the suppliers test certificates and delivery documentation (in the case where feedstock is sourced externally) or with the production batch identity and associated production and test records (where the feedstock is manufactured in house by the strand Firm).

The heat or batch identity of each bundle or coil of feedstock shall be maintained up to the point of entry to the first wiredrawing, cold working or heat treatment process.

Production of batches and the size of batches shall be as defined in AS/NZS 4672. The identity of production batches (which may contain more than one feedstock heat or batch number) shall be maintained up to and including despatch to the customer.

Production records shall enable the heat and batch numbers of feedstock contained in each batch of finished product to be determined. Similarly, production records shall enable the finished product batches that contain any given feedstock heat or batch number to be determined.

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All items, bundles or coils of finished product shall carry durable identification that enables the heat number(s) and production batch from which it originated to be determined.

(Note: The requirements for items 3 and 4 above may be met by recording the date or date and shift of production of each item, bundle or coil of finished product, and also recording the heat or batch identities of related feedstock processed on the same day or day/shift. Other methods of achieving the outcomes required in 3 and 4 above are not excluded)

6. Product Testing

6.1 Production Testing by the Firm

The chemical, mechanical and dimensional properties shall conform to the requirements of AS/NZS 4672 and customer specifications. The rate of testing shall be not less than that laid down in AS/NZS 4672. Long-term quality levels shall be determined for each size/grade combination in the manner specified AS/NZS 4672.

The complete individual test results comprising the Firm's long-term quality level analysis shall be submitted in the approved format to ACRS on a confidential basis at three monthly intervals, or as otherwise notified by ACRS. These results shall be analysed by ACRS and will form part of subsequent Surveillance Assessments.

6.2 Assessment Sampling

The Firm shall advise ACRS in writing of its complete product range supplied to the requirements of AS/NZS 4672 at the time of initial application, or upon any change to its product range. ACRS shall thereupon decide the extent of Assessment sampling and testing required and advise the Firm accordingly.

The intent shall be to cover the entire range of product classified as "Common Sizes" in AS/NZS 4672, or as commonly produced by the Firm, and a representative sample of other sizes produced over the 3 year assessment cycle (Initial Assessment and 2 Surveillance Assessments), as follows:

1. At an Initial Assessment, sampling and testing will cover all "Common Sizes" (as defined in AS/NZS 4672, or as produced commonly by the Firm) up to a maximum of 3 sizes for each product type and form, per production line.
2. At a Surveillance Assessment, sampling and testing will cover one "Common Size" in each product type and form, per production line, and representative samples from other sizes produced by the Firm. The extent of this sampling shall be decided by ACRS, and advised to the Firm prior to the Surveillance Assessment.

6.3 Assessment Testing

The Firm is to detail the number of production lines at each mill. When the number of production lines is more than one, details of the strand manufactured on each line shall be provided.

Firm's test Certificates shall be supplied by the Firm for the Unit of Manufacture for each coil or bar selected for testing, reporting separately for each production line. Each certificate shall include the following Release test data:

- i. Diameter tolerance
- ii. Breaking force

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- iii. 0.1% Proof strength
- iv. Elongation
- v. Load-strain curve.
- vi. Relaxation (1000 hour, 330 hour or 160 hour extrapolated tests as per AS/NZS 4672.1 Appendix B at 80% minimum specified UTS). The actual relaxation test data shall also be supplied.

6.3.1 Assessment of Geometry and Tensile Properties

For each product size type, form and production line selected for Assessment testing, samples shall be taken from 3 separate Units of Manufacture. These samples shall be subject to testing at the frequency described in Table 1. At least 30% of such tests shall be witnessed by the ACRS Assessor.

Testing by ACRS shall be carried out at an independent, NATA registered testing authority, or other testing laboratory approved by ACRS. Samples for strength and ductility testing shall also be tested by the Firm.

6.3.2 Assessment of Relaxation Properties

At both initial and surveillance assessments, a review of the Firm's relaxation test procedures will be carried out, and examples of production testing procedures shall be witnessed by the Assessor, plus the start of at least one relaxation test.

330hr relaxation testing of the required matched pair samples shall be undertaken by an independent laboratory nominated by ACRS.

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Table 1.

Property	Number of tests per Unit of Manufacture
Diameter of individual wires (<i>strand only</i>)	1
Lay length (4m sample – (<i>strand only</i>))	1
General quality	1
Diameter tolerance	2*
Breaking force	2*
0.1%Proof Stress	2*
Elongation at Maximun Force	2*
Load strain	2*
Relaxation (1000 hour at 80% UTS)	1

* One sample shall be taken from each end of the coil for wire and strand

6.4 Evaluation of Test Results

A statistical comparison of mill test results, and test results from independent test houses, shall be undertaken for each test size/grade and production line. The samples shall be deemed to comply with the requirements of each Assessment if:

1. All Release Witnessed and Independent results conform to the requirements of AS/NZS 4672, and
2. The results for dimensional properties of Witnessed and Independent samples show close agreement, and,
3. The strength and elongation properties for Witnessed, Release and Independent samples differ by < 5% and 10% respectively from the middle value. Greater differences may be permissible provided that the Independent results are more favourable than the Witnessed results.
4. The maximum projected relaxation loss at 80% of the characteristic minimum breaking force (70 % for as drawn steel wire and hot rolled bars) does not exceed the values shown in the relevant tables of AS/NZS 4672.

6.5 Sample Selection

ACRS assessors shall select all samples for the above test programs.