

APPENDIX 2

Quality and Operations Assessment Schedule for Carbon Steel Bars for the Reinforcement of Concrete Including Inspection and Testing Requirements.

1 Scope

This Schedule describes minimum quality and operational control requirements for the manufacture of carbon steel bars conforming to the requirements of AS/NZS 4671 Grades 250N, 500N and 500L for the reinforcement of concrete, and is additional to the quality management, operational and general requirements contained in Appendix 1.

It covers the manufacture of hot rolled bars and reinforcing bar in coil form, commencing with the production of liquid steel, and extending through to final despatch of product to the purchaser.

2 Steelmaking

- 1 There shall be documented procedures for the control of melting, refining and deoxidation parameters. The efficacy of such controls will be monitored by analysis of heat to heat variation in cast analyses, control of residual elements, and cast billet quality.
- 2 There shall be defined chemistry ranges for the production of reinforcing steel, and defined procedures and responsibilities for accepting melted steel for further processing.

3 Casting

- 1 There shall be documented procedures for the control of critical casting variables, including but not limited to, control of steel temperature and casting speed.
- 2 There shall be documented procedures for sequence casting (if practised) that ensure heat separation at changeover.
- 3 There shall be some assessment of cast billet quality that ensures that only steel of suitable quality is released for further processing. Rectification of surface quality defects to obtain a suitable quality level is permitted.
- 4 Where billets are produced for external sale, integration of billets from more than one heat or cast shall not be performed.

4 Rolling

- 1 All feed billets shall be identified by a heat or cast number. Heat or cast identity shall be maintained throughout all rolling mill processes up to and including receipt of product by the purchaser.
- 2 There shall be a documented procedure for integrating billets from more than one heat (when such practice is necessary) that sets defined limits on the variation in chemical composition permitted within the integrated heats. These limits should ensure that the

APPENDIX 2	Approved By:	Position:	Date of Issue:	Page:
	Philip Sanders	Executive Director	29/05/06	1 of 4

processing characteristics and expected properties would show minimal variation within the integrated heats.

- 3 *There shall be a defined schedule for the heating of billets, including corrective action in the case of extended heating delays that ensures a consistent and controlled rolling temperature.*
- 4 The temperature of billets during rolling shall be monitored, and adjustments to furnace or mill operation parameters made to ensure consistent and appropriate rolling temperatures.
- 5 *There shall be documented procedures for controlling and monitoring the cooling of steel after rolling. Mill operating parameters shall be quickly capable of restoring correct cooling schedules should variation outside the defined limits occur. Material that has not received the specified cooling conditions shall be isolated and tested separately to ensure conformance with specification and customer requirements.*
- 6 There shall be documented procedures for monitoring and recording dimensional and shape control that ensure that all product conforms to specification and customer requirements.
- 7 There shall be documented procedures covering the control of bar lengths, bundle bar counts and bundle mass that ensure that all product meets specification and customer requirements.

5 Traceability

Individual and integrated heat identity shall be maintained throughout all mill operations including the despatch of finished product to the customer. It shall be possible to cross reference all product bundles with relevant process control data, and test results.

6 Product Testing

6.1 Testing by the Manufacturer

The dimensional, chemical and mechanical properties of the reinforcing bar or coil shall conform to the requirements of AS/NZS 4671 and customer specification. The rate of testing shall, as a minimum, conform to that laid down in AS/NZS 4671.

Long-term quality levels shall be determined for each size/grade combination in the manner specified in AS/NZS4671 or the customer's standard as appropriate. The test results for the manufacturer's long-term quality level analysis shall be submitted to ACRS at three monthly intervals. These shall be analysed at ACRS and will form part of subsequent surveillance inspections.

6.2 Testing by ACRS

a Test program

For each manufacturing process and each grade of steel the test program for the Initial Assessment and subsequent Surveillance Inspections shall be as described in Table 1. Testing shall be in accordance with AS/NZS 4671. At the time of initial testing at least three casts of steel of each type shall be available for the selection of the test pieces.

APPENDIX 2	Approved By:	Position:	Date of Issue:	Page:
	Philip Sanders	Executive Director	29/05/06	2 of 4

Table 1

Inspection	Diameter	Frequency
Initial Assessment	Upper, middle and bottom of diameter range	Three casts per diameter of bar/coil
Surveillance Inspection	One diameter	Three casts per diameter of bar/coil

For each diameter selected for test, ten samples shall be selected from each cast. These shall be subject to testing at the frequency described in Table 2. Testing shall be carried out to the satisfaction of the ACRS and ACRS Assessors shall witness not less than 30% of the testing.

Table 2

Property	Number of tests per cast of bar/coil diameter
CSA and Mass	5
R_m	5
R_e	5
R_m/R_e	5
A_{gt}	5
Rebend	3
Rib Geometry	1
Chemistry	1
Macro (where applicable)	1

b Duplicate Samples

For each test sample described above, a duplicate sample shall be taken to be tested by an independent NATA approved test house. The number of tests may be increased in the event of any anomalies or difficulties.

c Evaluation of Test Results

A statistical comparison of product release test results, test results on duplicate samples, and test results from independent test houses, shall be undertaken for each test program. The statistical comparison shall take into account the product form and process route.

The samples shall be deemed to comply with the requirements for yield strength (R_e) if for each cast sampled –

- i no result falls below 95% of the specified minimum characteristic value; and
- ii no result exceeds 105% of the specified maximum characteristic value; and
- iii not more than one result falls below the specified minimum characteristic value or above the specified maximum characteristic value; and
- iv the mean of the results for each cast lies between 1.02 times specified minimum characteristic value and 0.98 times specified maximum characteristic value, or all results for each cast lie within the specified range.

The samples shall be deemed to comply with the requirements for Elongation (A_{gt}) and Ratio (R_m/R_e) if the mean of the results for each cast exceeds the specified characteristic value.

APPENDIX 2	Approved By:	Position:	Date of Issue:	Page:
	Philip Sanders	Executive Director	29/05/06	3 of 4

d Bond Performance (AS/NZS 4671 Grade 500)

i Performance by Measurement

Where rib configurations of deformed bars are shown to conform, by measurement of the projected rib area, to the requirements of AS/NZS 4671 then a Bond Test need not be carried out. The testing frequency shall be as described in Tables 1 and 2 – Rib Geometry.

ii Performance by Bond Test

Bond tests as described in AS/NZS4671, may be carried out on those deformed bars whose projected rib areas do not conform to the requirements of that standard. The bond test frequency required to establish the bond performance is six test pieces from each size within the approved size range of the manufacturer

An independent, NATA approved test house shall carry out the bond Tests.

Where bond testing is used to confirm bond performance the minimum rib dimensions under test shall be recorded and will form part of the manufacturer's production and inspection procedures. Compliance with these shall form part of subsequent ACRS inspections.

e Sample Selection

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

APPENDIX 2	Approved By:	Position:	Date of Issue:	Page:
	Philip Sanders	Executive Director	29/05/06	4 of 4