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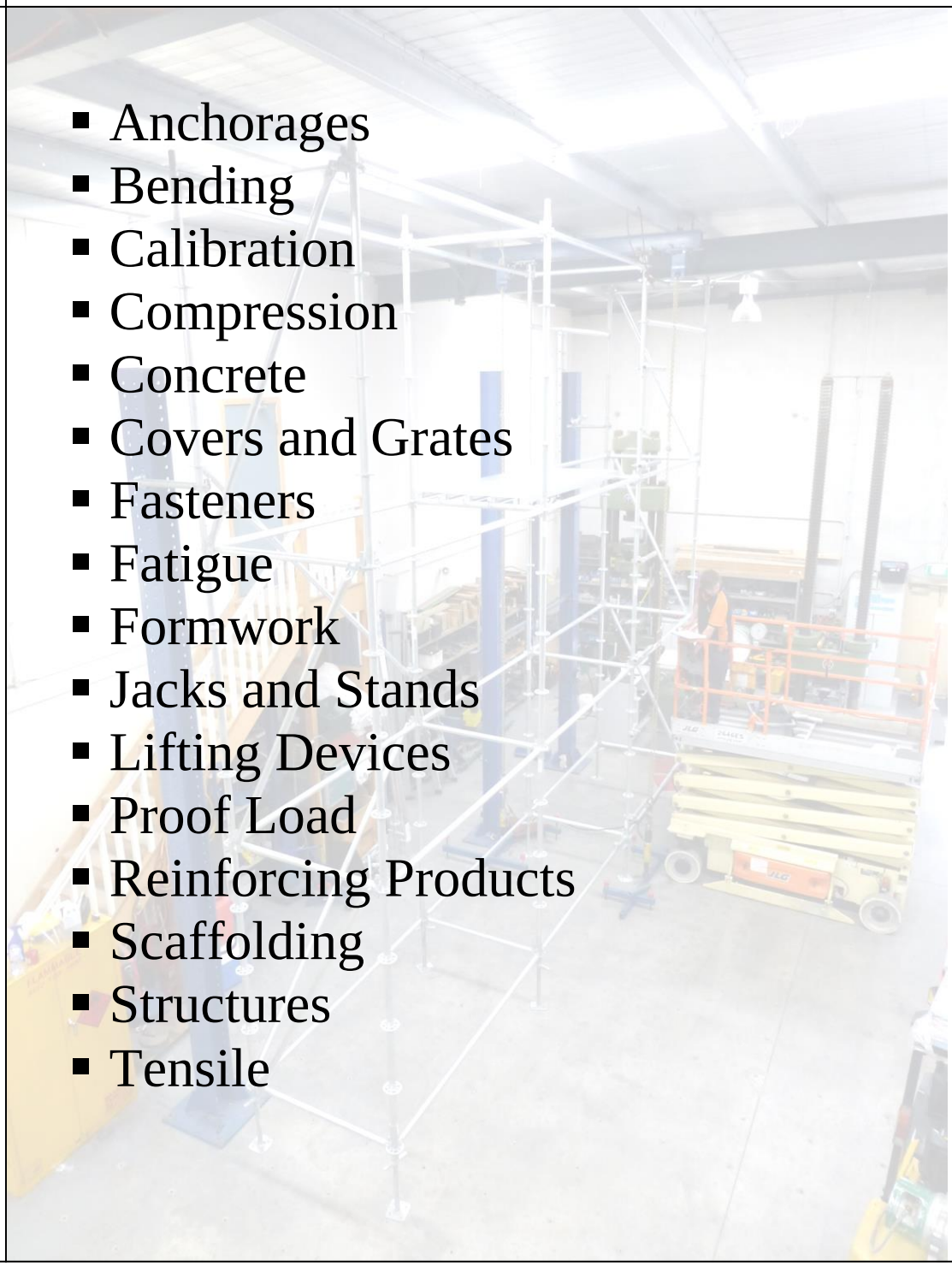
Mechanical Testing



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IN CONFIDENCE TO THE CLIENT

REPORT NO: MT-15/392-B

LOAD TESTING OF CORONET RINGLOCK MODULAR SCAFFOLD SYSTEM

CLIENT: **CORONET GROUP SUZHOU CO. LTD.**
ATT: MR KENT QIU
SIFC SIP, SUZHOU CITY
JIANGSU PROVENCE, CHINA

DATE OF TEST: SEPTEMBER 9TH TO NOVEMBER 11TH 2015

DATE OF REPORT: NOVEMBER 3RD 2015

TEST SYNOPSIS:

A CORONET Ringlock scaffold system was to be tested by MTS to determine the vertical load carrying capacity of the assembled frame. The independent and modular scaffold system was assembled in an enclosed environment at the MTS laboratory in accordance with the client's installation instructions.

The scope of the test was to determine the maximum height limits of the scaffold assembly, number of fully-planked platforms, number of screened platforms and the number of working platforms. Testing was to be conducted in accordance with an approved test procedures conforming to the requirements of AS/NZS 1576.3:2015 SCAFFOLDING, PART 3: PREFABRICATED AND TUBE-AND-COUPLER SCAFFOLDING.

FIG.1
CORONET RINGLOCK SCAFFOLD TEST ASSEMBLY

In addition to the aforementioned load testing, MTS was to conduct dimensional analysis and material properties testing of the relevant CORONET scaffolding components to determine the items' compliance with AS/NZS 1576.1:2010 APPENDIX A and AS/NZS 1576.3:2015 SECTION 2.

SCAFFOLD IDENTIFICATION:

Each individual item used in the scaffold assembly was visually inspected for identification markings. Metal stamped identification marks '*Coronet AS/NZS 1576*' were observed on all components including standards, ledgers, transoms, braces, hop-ups and adjustable screw jacks.

TEST PREPARATION:

Prior to erecting the test scaffold, the mass and dimensional attributes of each scaffolding component were measured and recorded for the determination of the assembled scaffold gravity dead loads (G_d). All measurements were conducted using calibrated MTS measuring devices and are provided in Appendix A of this report. MTS wishes to advise the reader that, as per the design of the CORONET Ringlock scaffold system, the ledger and transom components are interchangeable units and share similar dimensional attributes.

SCAFFOLD TEST SET-UP (AS-ERECTED):

In accordance with AS/NZS 1576.3:2015 APPENDIX B, the test scaffold was assembled to provide a three (3) bay long by three (3) lift high test assembly. At the height of the second lift at each end, the test scaffold was rigidly tied to a supporting structure.

A description of the test scaffold assembly is summarised as follows:

Scaffold Height:	*6.0m – Three (3) x 2.0m lifts plus Adjustable Screw Jacks*
Scaffold Length:	*7.2m – Three (3) x 2.4m bays*
Scaffold Width:	*1.2m (nom.)*
Standards:	*2.0m (nom.) and 3.0m (nom.), assembled with staggered joints*
Transoms:	*Located at 2.0m (nom.) elevations, fitted between lateral standards*
Ledgers:	*Located at 2.0m (nom.) elevations, on both sides of the structure*
Face Bracing:	*One brace per 2.0m (nom.) elevation, located every 3rd bay*
Lateral Bracing:	*Fitted at both ends of the test scaffold at every 2.0m elevation (every lift)*
Planks:	*Four (4) x 2.4m planks on the 3rd lift of the 2nd bay*

Adjustable Screw Jacks: *Fitted in the fully extended position of 452mm*

FIG.2
SCAFFOLD UNDER TEST

SCAFFOLD TEST PROCEDURES:

Load testing was to be conducted on two (2) laterally adjacent standards using an MTS loading beam mounted on top of the spigot ends of the test standards. The test standards were located at the third pair of laterally adjacent standards, or Bay #3 of the test structure (see Fig.2).

Test loads commensurate to specific scaffold assembly configurations (refer to *Scaffold Assembly Configuration* of this report) were progressively applied to the loading beam using a pair of identical hydraulic cylinders positioned symmetrically on the outer side loading beam. Calibrated MTS 70kN load cells (Model: Yuyao Pacific) were coupled to the hydraulic actuators and used to record the applied test force.

As per AS/NZS 1576.3:2015 APPENDIX B CLAUSE B5.2, three incremental load cases, namely Working Loads "P_W", Design Loads "P_D" and Strength Loads "P_M", were to be applied and maintained for a minimum period of 5 minutes for each scaffold assembly configuration. Transverse deflection of the test standards were measured and recorded under load and upon removal of load.

SCAFFOLD ASSEMBLY CONFIGURATIONS:

In consultation with the client, a range of scaffold assembly configurations were engineered in order to achieve a staged increase in test load. Each stage was commensurate with a nominated scaffold height and an interval number of working platforms.

All load tests were computed using dead loads commensurate for:

a) fully-planked scaffold (lifts at 2.0 metre intervals)
b) two ledgers installed as guardrails on the outer side of each lift and one ledger installed mid-lift on the inner (building) side scaffold assembly
c) two board platform (hop-up) and toe boards at each lift (2.0 metre intervals)
d) gravity loads associated with safety screens (infill panels) were assumed to be applied symmetrically over the scaffold
e) Face brace at every 2.0m (nom.) elevation

CALCULATION OF TEST LOADS FOR SCAFFOLD ASSEMBLIES

Test forces for Working Loads "P_W", Design Loads "P_D" and Strength Loads "P_M" for scaffold assembly configurations were calculated in accordance with AS/NZS 1576.1:2010 and AS/NZS 1576.3:2015 APPENDIX B. Dead loads "G_d" were calculated from the test data provided in Table A1 (Appendix A of this report) for scaffold test scenarios described below. A live load "Q" of 6.6kN, corresponding to a heavy duty scaffold was adopted for the tests.

FIG.3
SCAFFOLD UNDER PEAK LOAD

Test Scenario 1

Scaffold height:	10m
No. of Working Platforms:	1
G_d – Gravity Loads:	11.1kN
P_W – Calculated Working Load:	7.0kN
P_D – Calculated Design Load:	11.5kN
P_M – Calculated Strength Load:	18.1kN

Test Scenario 2

Scaffold height:	16m
No. of Working Platforms:	1
G_d – Gravity Loads:	17.6kN
P_W – Calculated Working Load:	10.3kN
P_D – Calculated Design Load:	16.3kN
P_M – Calculated Strength Load:	25.4kN

Test Scenario 3

Scaffold height:	10m
No. of Working Platforms:	2
G_d – Gravity Loads:	11.1kN
P_W – Calculated Working Load:	10.3kN
P_D – Calculated Design Load:	16.4kN
P_M – Calculated Strength Load:	25.5kN

Test Scenario 4

Scaffold height:	20m
No. of Working Platforms:	1
G_d – Gravity Loads:	22.0kN
P_W – Calculated Working Load:	12.5kN
P_D – Calculated Design Load:	19.6kN
P_M – Calculated Strength Load:	30.4kN

TEST RESULTS AND OBSERVATIONS:

For each test scenario and load case (P_W, P_D and P_M) listed above, the scaffold test structure successfully maintained the applied test loads for the specified period of 5 minutes. There were no visible cracks in the material or welding of the components.
After removal of P_W and P_D loads, permanent deflections of the loaded standards were observed to be negligible and within the allowable lateral deflection limit of 6.2mm (based on the test structure total height), in accordance with AS/NZS 1576.3:2015 APPENDIX B, CLAUSE B6.
Incremental loading of the scaffold test structure resulted in a peak force of **34.8kN** and both test standards were observed to buckle inwards in the transverse direction (see Fig.3).

GEOMETRICAL AND MATERIAL PROPERTIES TESTING:

Geometrical and material properties tests were conducted for the specific direct load bearing scaffolding components as follows:

Transoms

The transoms were painted with a *'silver'* identification colour: **PASS**

The scaffold transoms were fabricated using 48.3mm (nom.) diameter and 3.2mm wall thickness tube. Tensile testing as conducted on a machined test piece procured from tube confirms that the material properties of the transoms are as follows:

- Yield Strength of 414MPa: **PASS**
- Ultimate Tensile Strength of 491MPa: **PASS**
- Post-Fracture Elongation of 25%: **PASS**

The material properties of the transom are provided in Appendix B.

Standards

The scaffolding standards were fabricated using ERW steel tube with an outer diameter of 48.3mm (nom.) and a wall thickness of 3.2mm (nom.): **PASS**

The bearing ends of the standards were cut cleanly and square with the axis of the tube: **PASS**

The external surface only of the standards was painted with a *'silver'* identification colour: **PASS**

Tensile testing as conducted on a machined test piece procured from the wall of a standard confirms that the material properties of the standards are as follows:

- Yield Strength of 484MPa: **PASS**
- Ultimate Tensile Strength of 575MPa: **PASS**
- Post-Fracture Elongation of 22%: **PASS**

The material properties of the standard are provided in Appendix B.

TEST SUMMARY:

Dimensional analysis and material properties testing confirms that the relevant CORONET scaffolding components have met the specific requirements of AS/NZS 1576.1:2010 APPENDIX A – CLAUSE A5. Furthermore, the aforementioned testing regime verifies that the relevant scaffolding components met the specific requirements for AS/NZS 1576.3:2015 SECTION 2 – CLAUSE 2.1, CLAUSE 2.4.2 & CLAUSE 2.4.3.1.

It is important to note that this test report is limited to the installation procedures and the specific scaffolding components (see Table A1, Appendix A) as used during load testing of the test structure.

Testing as described and reported herein verifies that the CORONET Ringlock modular scaffold has met the performance requirements of AS/NZS 1576.3:2015 - APPENDIX B for the specific test scenarios provided in this report.

The CORONET Ringlock modular scaffold when erected as per "*Scaffold Assembly Configurations*" provided in this report is limited to a maximum scaffolding height of twenty (20) metres and one (1) working platform (Test Scenario 4).

PARTIALLY PLANKED SCREENED SCENARIOS:

In the instance where the scaffolding structure is partially planked (in lieu of scaffold planked every 2m as reported and tested herein), MTS has provided in Appendix C other scaffolding plank scenarios and scaffold assembly heights. The dead loads and live loads for partially planked and screened scaffolds were computed from appropriate dead loads and live loads for the specific structure. The total factored dead loads and factored live loads for partially planked scenarios reported in Appendix C were less than the scaffold ultimate strength load of 34.8kN.

TEST FACILITY:

All testing was carried-out by Test Engineers Dr. Siva Naidoo and Carey Arthurson in an enclosed environment at the MTS laboratory. Testing was conducted between 9th September and 11th November 2015.

Notes:

1. Melbourne Testing Services Pty Ltd shall not be liable for loss, cost, damages or expenses incurred by the client or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Melbourne Testing Services Pty Ltd be liable for consequential damages including, but not limited to, lost profit, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested.
2. This report only indicates compliance of the scaffold assembly in its state at the time of testing. It should not be taken as a statement that all similar scaffolds or components of scaffolds in all states of repair, would also be found to comply.
3. It remains the responsibility of the client to ensure that the scaffolding components as reported herein are representative of the entire production batch.
4. As described and reported herein, the load capacity of the CORONET Ringlock modular scaffold assembly is specific to the requirements of AS/NZS 1576.3:2015 APPENDIX B.
5. MTS shall take no responsibility for the load performance attributes of scaffold assemblies which are erected other than as specifically described under the heading "Scaffold Assembly Configurations" on Page 2 of the MTS test report (MT-15/392-B).
6. MTS shall take no responsibility for the load performance of scaffold assemblies constructed from scaffolding components other than those specifically described in Table A1 of the MTS test report (MT-15/392-B).
7. The load performance attributes of partially planked and screened scaffold assemblies, as described in Appendix A of the MTS test report (MT-15/392-B), are specific to scaffolding components as described in Table A1.
8. MTS shall take no responsibility for the procurement and authenticity of the scaffold as described herein.
9. MTS shall take no responsibility for the installation procedures used for the scaffold described herein.

DR. SIVA NAIDOO

AUTHORISED SIGNATORY

BENG (MECH) HONS. PH.D (ENG)

APPENDIX A:

Scaffold Item	Length of Item (mm)	Mass Per Item (kg)	Comments
Standard 2m	2110	9.6	2m (nom.) standard with spigot, 48.3mm outside diameter, 3.2mm wall thickness
Standard 3m	3110	14.5	3m (nom.) standard with spigot, 48.3mm outside diameter, 3.2mm wall thickness
Ledger/Transom 1.22m	1175	4.7	1.2m (nom.) ledger/transom, 48.3mm outside diameter, 3.2mm wall thickness
Ledger/Transom 1.8m	1780	7.1	1.8m (nom.) ledger/transom, 48.3mm outside diameter, 3.2mm wall thickness
Ledger/Transom 2.44m	2385	9.1	2.4m (nom.) ledger/transom, 48.3mm outside diameter, 3.2mm wall thickness
Diagonal Face Brace 3m	3085	10.7	3m (nom.) brace , 48.3mm outside diameter, 2.5mm wall thickness
Lateral End Brace 2.4m	2315	8.3	2.4m (nom.) brace, 48.3mm outside diameter, 2.5mm wall thickness
Plank 1.2m	1220	8.6	1.2m (nom.) plank, pressed metal with perforations. Explicit dimensional details in MTS report: MT-15/392-A
Plank 1.8m	1830	12.6	1.8m (nom.) plank, pressed metal with perforations. Explicit dimensional details in MTS report: MT-15/392-A
Plank 2.4m	2440	15.6	2.4m (nom.) plank, pressed metal with perforations. Explicit dimensional details in MTS report: MT-15/392-A
One Board Hop-Up Bracket	N/A	4.2	Welded tube sections 42mm (nom.) outside diameter, 2.5mm wall thickness & 48.3mm (nom.) outside diameter, 3.2mm wall thickness
Two Board Hop-Up Bracket	N/A	5.7	Welded tube sections 42mm (nom.) outside diameter, 2.5mm wall thickness & 48.3mm (nom.) outside diameter, 3.2mm wall thickness
Adjustable Screw Jack	N/A	6.5	Explicit dimensional details in MTS report: MT-15/392-D
Start Collar	N/A	1.77	48.3mm (nom.) outside diameter, 3.2mm wall thickness spigot & 57mm (nom.) outside diameter, 2.5mm wall thickness sleeve

TABLE A1
NOMINAL DIMENSIONS OF CORONET SCAFFOLD COMPONENTS (AS-DELIVERED)

APPENDIX B:

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Tensile Test Report

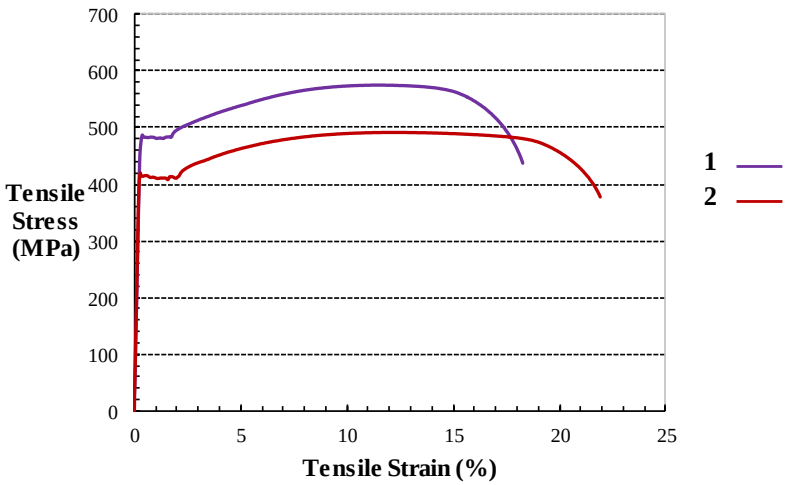
Report No: MT-15/392-G
Report Date: 27-Nov-15
Specimen Description: Scaffolding Parts
Testing Machine: TE Universal

Client:
Coronet Group Suzhou Co Ltd
No1,Suhua Rd, Sip Suzhou
Jiangsu , 215021 China

TEST DETAILS

Test Date:	***6/11/2015***		1	2
Specimen I.D:			**Standard**	**Transom**
Extensometer Gauge Length:	L_e	(mm)	50	50
SPECIMEN DETAILS				
Thickness:	a	(mm)	3.00	3.02
Width:	b	(mm)	12.60	12.59
Area:	S_o	(mm^2)	37.80	38.02
Gauge Length:	L_o	(mm)	35	35
Parallel Length:	L_c	(mm)	70	70
TENSILE PROPERTIES				
Tensile Strength:	R_m	(MPa)	575	491
Proof Stress:	$R_{p0.2}$	(MPa)	484	414
Post Fracture Elongation:	A	(%)	22	25

Test Comments:
Tested in accordance with
AS 1391-2007. and AS 1163-2009



ROD WILKIE
Authorised Signatory

APPENDIX C:

PARTIALLY PLANKED AND SCREENED SCAFFOLD EVERY FOUR (4) METRES

Minimum Strength Test (P_M) computed to be 26.3kN

MAXIMUM ASSEMBLED HEIGHT	***30 METRES***
MAXIMUM NUMBER OF PLANKED AND SCREENED PLATFORMS	***8***
MAXIMUM NUMBER OF CLOSED. PLATFORMS	***7***
MAXIMUM NUMBER OF WORKING PLATFORMS	***1***
MAXIMUM NUMBER OF HOP UPS	***8***
MAXIMUM SCREW JACK HEIGHT	***452mm***

PARTIALLY PLANKED AND SCREENED SCAFFOLD EVERY SIX (6) METRES

Minimum Strength Test (P_M) computed to be 25.4kN

MAXIMUM ASSEMBLED HEIGHT	***36 METRES***
MAXIMUM NUMBER OF PLANKED AND SCREENED PLATFORMS	***7***
MAXIMUM NUMBER OF CLOSED. PLATFORMS	***6***
MAXIMUM NUMBER OF WORKING PLATFORMS	***1***
MAXIMUM NUMBER OF HOP UPS	***7***
MAXIMUM SCREW JACK HEIGHT	***452MM***