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Certificate of Compliance

Project	Design verification of the design for a Pipe Handler attachment and associated Fusion Coupler adapter attachment	**Author**	[redacted]
Client	[redacted]	**Date**	6 August 2024
Project No.	[redacted]	**Revision**	0

Scope

As requested by QMW Industries Pty Ltd, Practical Engineering Australia has performed a design assessment of the design of a Pipe Handler attachment (part no. 1-2393) connected by way of a Fusion Coupler adapter attachment (part no. 1-2916) to the front arms of a CAT 982M front loader. The design of the two attachments was checked to the following design data and relevant sections of the listed Australian and International Standards.

Figure 1: Pipe Handler (1-2393) and Fusion Coupler (1-2923) lifting attachment assemblies.

Design Data

The following design data has been provided by Wilson Industries Pty Ltd and used to assess the lift lug plates:

- Email "*RE: QMW006 - CAT 982 Attachment Design Certification - RFI*" from Joel Hansell to Ryan McNamara on Thu 13/06/2024 at 7:35 AM and containing the following documents and drawing folders:
  - Document Folder TEST DATA
  - Drawing Folder PIPE HANDLER 1-2923
  - Drawing Folder FUSION COUPLER 1-2916
  - Drawing Folder FORK CARRIAGE 1-2879
  - Drawing Folder COUNTERWEIGHT 1-2931
- Email "*RE: QMW006 - CAT 982 Attachment Design Certification - RFI 2*" from Alex Love to Ryan McNamara on Fri 21/06/2024 at 8:21 AM
- Email "*RE: QMW006 - CAT 982 Attachment Design Certification - RFI 3*" from Alex Love to Ryan McNamara on Tue 25/06/2024 at 6:53 AM
- Email "*RE: QMW006 - RFI 5 - Pipe handler forklift tyne capacity*" from Alex Love to Ryan McNamara on Tue 25/06/2024 at 7:55 AM:
  - Dwg File 1-2923_CA_2.dwg
  - PDF File 1-2923_CA_2.pdf
- Email "*RE: QMW006 - RFI 5 - Pipe handler forklift tyne capacity*" from Alex Love to Ryan McNamara on Tue 25/06/2024 at 7:55 AM and containing the following document:
  - STP File 1-2923_B.stp
- Email "*RE: QMW006 - RFI 5 - Pipe handler forklift tyne capacity*" from Alex Love to Ryan McNamara on Tue 25/06/2024 at 10:17 AM and containing the following document:
  - PDF File Z240417 mechanical performance test report 20090.pdf
- Email "*RE: QMW006 - RFI 6 - 60mm lug attachment weld detail*" from Alex Love to Ryan McNamara on Wed 26/06/2024 at 6:22 AM
- Email "*RE: QMW006 - Assessment results*" from Alex Love to Ryan McNamara on Wed 29/06/2024 at 2:39 PM and containing the following documents:
  - PDF File 1-2923.pdf
  - PDF File 1-2916.pdf
  - PDF File 12T HYDRAULIC PIPE CLAMP 1-2923.pdf

The following design data has been provided by Practical Engineering Australia and is applicable for the testing of the two attachment assemblies:

- QMW006-RPT Required Attachment Testing Rev D

Applicable Drawings

The following drawings have been provided by QMW Industries Pty Ltd and apply for the design of the two lifting attachments covered by this certification:

- 1-2923-001 Rev A (received 29/06/24) 8T HYDRAULIC PIPE CLAMP (and associated supporting drawings received)
- 1-2916 Rev A (received 29/06/24) QUICK COUPLER CAT 982 (and associated supporting drawings received)

Applicable Standards

The relevant sections of the following Australian Standards were used to assess the the two lifting attachments' designs:

AS 2359.1-2019	Powered industrial trucks, Part 1 - General requirements
AS 2359.6-2013	Powered industrial trucks, Part 6 - Self-propelled industrial trucks
AS 2359.14-2005	Powered industrial trucks - Fork arms - Technical characteristics and testing
AS 4100-2020	Steel Structures
AS 4991-2004	Lifting devices
AS/NZS 1170.0:2002	Structural Design Actions – Part 0: General Principles
AS/NZS 1554.1:2014	Structural steel welding, Part 1 - Welding of steel structures

Operational Limits

The following operational limits apply:

- Working Load Limit (WLL) of pipe handler attachment:
  - 12 tonnes at 600 mm from leading vertical face of fork lift tynes. Loading distributed evenly onto both fork tynes.
  - The product of any lift load and distance from leading vertical face of fork lift tynes shall not exceed 35.3 kN.m bending moment at the end junction of each of the fork tynes
  - Any lift load shall be evenly distributed onto both fork tynes of the pipe handler attachment
- Performance characteristics of 3in hydraulic cylinders on pipe handler clamping arms:
  - Maximum permitted pressure rating of 2320psi (160 bar)
  - Maximum push force at maximum pressure rating 72.95 kN
- Performance characteristics of 2.5in hydraulic cylinders on fusion coupler locking mechanism:
  - Maximum permitted pressure rating of 2320 psi (160 bar)
  - Maximum push force at maximum pressure rating 50.65 kN
- Approximate component tare weights:
  - Pipe Handler attachment – 2.1 tonnes
  - Fusion coupler attachment – 1.2 tonnes

Figure 2: Permitted maximum position of applied loading at the Rated Capacity magnitude.

Certification Requirements

The certification requirements are:

- The two lifting attachment components covered by this design verification shall only be used within the design operational conditions listed in the above operational conditions section. Assembly of both the Pipe Handler and Fusion Coupler attachment assemblies shall be as per referenced drawings listed above and stated certification requirements listed below;
- Fusion Coupler adapter attachment shall be used to connect the Pipe Handler attachment to the front arms of a CAT 982M Front Loader. All four connection points on the Fusion Coupler shall be used to connect to the supporting CAT 982M Front Loader. Connecting pins between CAT 982M and Fusion Coupler shall be within 2mm in diameter of the provided hole bores on the Fusion Coupler;
- Fusion Coupler is only certified for use with the Pipe Handler and the associated loads applied by it onto the Fusion Coupler;
- Supporting CAT 982M Front Loader with Pipe Handler and Fusion Coupler attachments attached shall be capable of meeting the stability requirements stated in AS 2329.6:2013 Clause 4.8;
- A lifting instruction must be supplied with the attachment from the manufacturer that states the operational limits of the attachment;
- Truck attachment shall be supplied to end user with an instruction manual that states safe use of attachment and any safety precautions applicable to its use;
- Hydraulic systems shall not exceed the maximum pressure rating stated in operational conditions section above. Specified hydraulic cylinders shall be able to withstand the maximum compressive force from the maximum permitted hydraulic pressure at maximum extension;
- Prior to operational use the lifting attachments shall be subject to the testing regime described in referencing testing requirements document "*QMW006-RPT Required Attachment Testing Rev D*" referenced above;
- All welding is to comply with SP Type quality level as per AS 1554.1:2014 Structural Steel Welding, Part 1: Welding of steel structures. Minimum inspection requirements for welds are as follows: 100% Visual

Scanning; and 10% Visual Examination. All fillet welds shall be continuous fillet welds. All butt welds shall be full penetration unless specifically stated otherwise in referenced drawings. Minimum nominal tensile strength of weld filler material shall be 490 MPa. Welding of any AISI 1045 steel bar shall use low hydrogen electrode material and welding shall use pre-heating in accordance with AS/NZS 1554.1 requirements; and

- WLL stated is for load only applied to the top horizontal surface of the pair of fork tynes of the Fork Carriage attachment. Any load on the fork tynes of the Pipe Handler attachment shall be evenly distributed between the two forks and the COG of the load should be located coincident with the longitudinal mid plane of the attachments and the CAT 982M truck. Load on forks shall be restrained appropriately using clamp arm of the Pipe Handler attachment to prevent movement. If stability of loading is uncertain the load should be directly lashed to the back frame of the Pipe Handler attachment. The forks of the Pipe Handler assembly should be angled back as an extra precaution to prevent longitudinal movement of applied load during any transport.

Markings

Required markings of Pipe Handler complete with Fusion Coupler attachments in accordance with AS 2359.6 requirements shall include the following:

1. Name and address of the attachment manufacturer: [QMW Industries, 53 Success Street, Brisbane QLD]
2. Model Number: [1-2923 (Pipe Handler) / 1-2916 (Fusion Coupler)]
3. Serial Number: [AS-BUILT]
4. Tare Mass: [3.3 tonnes]
5. Distance of the centre of gravity of the attachment from its mounting face on the truck: [943 mm] (as shown below)
6. Total Rated capacity: 12 tonnes
7. The maximum operating pressure of all hydraulic cylinders: 2320 psi
8. Maximum load centre : [600mm from fork tyne heel junction at Rated Capacity]
9. The instruction *"The capacity of the truck and attachment combination shall be complied with"*

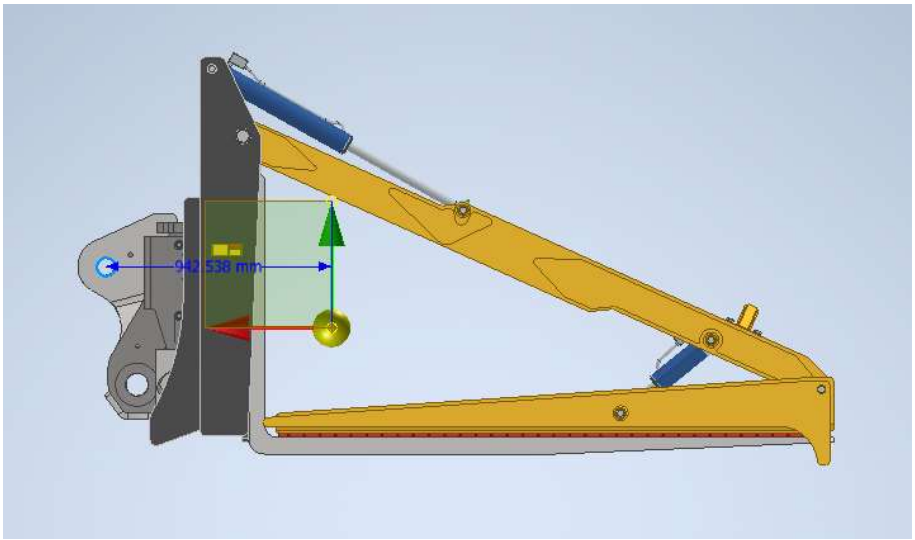


Figure 3: COG location for combined Fork Carriage and Fusion Coupler assemblies.

Maintenance Requirements

Recommended maintenance shall include:

- It is recommended that the lifting attachment shall be inspected visually for signs of wear, cracks, nicks, gouges, corrosion, stretching or deformation before use as intended post proof testing and periodically during the life of the attachments. Particular focus should be given to the welded and pin connections.
- Hydraulic systems shall be periodically checked to ensure mechanical systems whose power is dependent on them is not compromised and works as intended;

Exclusions

The following items have been excluded from this certification:

- Functional review of the listed pieces of equipment. The scope of works is for structural assessment only.
- Engineering analysis including stability analysis of the CAT 982 vehicle platform and systems;
- Engineering analysis on equipment, structures or components other than the 18T Fork Carriage, CAT982 Quick Coupler and 8T Hydraulic pipe clamp;
  Engineering analysis on any attachment hydraulic components or hydraulic system operations;
- Development of CAT 982 attachment testing procedures or conditions;
- Fatigue or dynamic loading assessment of the Fusion Coupler and Pipe Handler attachments;
- Engineering analysis or certification of proprietary equipment such as hydraulic cylinders or hydraulic systems; and
- Certification of as-built equipment for conformance to the certified design.

Safety in Design

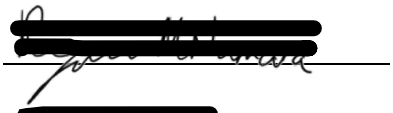
During the design process, the design verifier has ensured that, given the information provided, the equipment has been designed to minimise risks to the health and safety of all parties.

The following remaining potential operational hazards have been identified. This list is not exhaustive. A risk assessment **must be** completed by the equipment user prior to use.

Hazard	Cause	Consequence	Suggested Control
Structural design of lifting attachments	Incorrect or insufficient design aspects	Limitation on life of structure. Performance of structure degraded.	Design and fabricate lifting attachments to recognised structural Standard (AS 4100). Perform fabrication and performance testing as per AS 2359.1 and AS 2359.6 requirements Perform periodic inspection of structure.
Lifting of structure creates falling load hazard	Lifting of structure	Danger to adjacent personnel	Use agreed upon mandated lifting procedure. Use best practice for restraining lifted structures.

Design Verification Approval

I, Ryan McNamara, verified that the design of the two related lifting attachments (Pipe Handler and Fusion Coupler) referenced above meets relevant sections of the listed International and Australian Standards subject to the limitations, requirements, and exclusions listed in this certificate. I have performed a theoretical design verification of the structural design of the lifting attachments in accordance with the requirements for a design verifier under the QLD Work Health and Safety Act 2011.



[redacted]
RPEQ Mechanical Engineer
BEng (Hons) (Mech), MIEAust, CPEng, NER, RPEQ (Mechanical, Pressure Equipment Design Verifier)
For and on behalf of Practical Engineering Australia.