



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

TUNRA
THE UNIVERSITY OF NEWCASTLE
RESEARCH ASSOCIATES

ABN 97 000 710 074

The University of Newcastle Research Associates
University Drive, Callaghan NSW 2308 Australia

www.tunra.com.au

General Manager: Dr Timothy Donohue

Tel. +61 2 4033 9031

Email: Timothy.Donohue@newcastle.edu.au

04 June 2021

Thermal Zinc Diffusion Galvanising Rebar Bending Test

RESEARCH REPORT

Reference: Q-19022021-007

Prepared For:

Engineer (Technical Development)

ArmorGalv (Aust) Pty Ltd

Ms Sonia James

sonia@armorgalv.com.au

Prepared By:

Dr Igor Chaves

T: +61 2 4921 2006

E: igor.chaves@newcastle.edu.au

Distribution:

TUNRA Copy

Igor Chaves Copy

Sonia James Copy



EXECUTIVE SUMMARY

Test Sample Description:	Straight uncoated and thermal zinc diffused galvanising (TZD) coated deformed ductility class reinforcement rebar offcuts of either 16 mm, 24 mm or 28 mm nominal diameter.
Applicable Standards:	AS4671:2019, § 7.2.2 Bending and re-bending properties [1] AS3600:2018, § 17.2.3.3 Straightening or re-bending internal diameter [8]
Location:	Bending: The Australian Reinforcement Company (ARC), 31 Creek Rd, Wallsend NSW 2287 Microscopy Analysis: The University of Newcastle, Civil Engineering Laboratories, Building ED University Drive, Callaghan, NSW 2308
Test Date:	Bending: 7 th May 2021 Microscopy Analysis: Pre-bend 3 rd May 2021, post-bend 10 th May 2021
Test Carried out by:	Dr Igor Chaves

Test Outcome:

	Rebar Sample	Nominal Diameter (d)	Bending Mandrel Diameter	Compliant to AS4671:2019 § 7.2.2
Uncoated Rebar	A	16 mm	4·d	Yes
	B	16 mm	4·d	Yes
	C	24 mm	4·d	Yes
	D	24 mm	4·d	Yes
	E	28 mm	4·d	Yes
	F	28 mm	4·d	Yes
TZD Coated Rebar	U	16 mm	4·d	Yes
	V	16 mm	4·d	Yes
	W	24 mm	4·d	Yes
	X	24 mm	4·d	Yes
	Y	28 mm	4·d	Yes
	Z	28 mm	4·d	Yes
	J	24 mm	5·d	Yes
	K	24 mm	5·d	Yes
	L	28 mm	6·d	Yes
	M	28 mm	6·d	Yes

NOTE: As per AS4671:2019 all ductility class N rebars of 16 mm and greater bent 180° around a mandrel of at least four times nominal diameter [1].

NOTE: AS3600:2018 sets minimal bending mandrel internal diameter of bends for reinforcement, in which the bend is designed to be subsequently straightened or re-bent: at least five times nominal diameter for 24 mm rebars, and at least six times nominal diameter for 28 mm rebars.

NOTE: As per AS4671:2019 § 7.2.2 After bending or re-bending there shall be no visible evidence of cracking on the surface of the test bar when inspected with the naked eye or with normal corrected vision.

REFERENCES

- [1] AS/NZS 4671:2019, Steel for the reinforcement of concrete, Standards Australia, published 13 December 2019. ISBN 978 1 76072 671 3
- [2] One Steel Reinforcing (2017), Essential technical data on steel reinforcement, Ed. 4.3, accessed via www.industry.gov.au on 14th May 2019.
- [3] Stema Pedax PERFEKT – Special SS S (2008), high performance production machine technical specification brochure, Published by STEMA Engineering and PEDAX Bitburg.
- [4] Huang Q., *et.al* (2020), Corrosion resistant plasma electrolytic oxidation coating modified by zinc phosphate and self-healing mechanism in the salt-spray environment, Journal of Surface and Coatings Technology, Vol. 384, Issue 125321.
- [5] ASTM G50-10 (2015), Standard practice for conducting atmospheric corrosion tests on metals, West Conshohocken, P. United states: ASTM International.
- [6] Champion F.A., (1965), Corrosion testing procedures, London Chapman & Hall.
- [7] Shreir L.L., Jarman R.A., Burstein G.T., (1995) Chapter 12.3 Principles of applying coatings by diffusion, in Corrosion, 3rd edition, Jordan Hill, Oxford, ISBN 0750610778
- [8] AS/NZS 3600:2018, Concrete structures, Standards Australia, published 22 June 2018. ISBN 978 1 76072 146 6.



Igor Chaves, PhD

Senior Lecturer

School of Engineering

The University of Newcastle

<https://www.newcastle.edu.au/profile/igor-chaves>

T: +61 2 4921 2006

E: igor.chaves@newcastle.edu.au



Timothy Donohue, PhD

General Manager

TUNRA

The University of Newcastle

<https://www.newcastle.edu.au/profile/timothy-donohue>

T: Tel. +61 2 4033 9031

E: Timothy.Donohue@newcastle.edu.au

Disclaimer

This report was prepared by TUNRA expressly for the customer as nominated on the front cover. Any person acting in its behalf making any warranty, express or implied, with respect to the use of any information or methods disclosed in this report assumes any liability with respect to the use of any information or methods disclosed in this report. Any recipient of this document, by their acceptance or use of this document, releases TUNRA and their affiliates from any liability for direct, indirect, consequential or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise, and irrespective of fault, negligence and strict liability. Email copies of this report are not official unless authenticated and signed by TUNRA and are not to be modified in any manner without the express written consent of TUNRA.

Sample Disposal

Test samples and off cuts of client test samples sent to TUNRA for investigation will be retained in a weather proof area for approximately one month after the report submission and for a further two months in external storage before disposal. If these parts are required by you then you must contact TUNRA to arrange pick up before this term has elapsed.