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European Technical Assessment

ETA 07/0046
of 29/11/2018

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: UK CARES

Trade name of the construction product
Product family to which the construction product belongs

Macalloy 1030 Post-Tensioning System
PAC 16 – Reinforcing and pre-stressing steel for concrete (and ancillaries). Post tensioning kits.

Manufacturer

MACALLOY LTD
Caxton Way
Dinnington
S25 3QE,
United Kingdom

Manufacturing plant(s)

MACALLOY LTD
Caxton Way
Dinnington
S25 3QE,
United Kingdom

This European Technical Assessment contains

38 pages including Annexes A to D which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

EAD160004-00-0301. Edition September 2016, Post Tensioning Kits for Prestressing of Structures

This European Technical Assessment replaces:

European Technical Assessment (ETA)
07/0046 of 20.09.17

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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1. Scope of European Technical Assessment

1.1 Description of the construction product

Macalloy's bar post-tensioning kit "Macalloy 1030 Post Tensioning Systems" is an internal bonded or unbonded system.

The kit supplied by Macalloy comprises plain bar 25mm-40mm diameter and ribbed bar 25mm-50mm diameter complying with prEN 10138, threaded coupler, anchor plate, washer and nut. The additional components not supplied by Macalloy are specified to comply with EAD160004-00-0301.

The concrete transfer strength of the system is $f_{cm, 0, \text{cube}} = 35\text{MPa}$ in accordance with EN 206-1:2013 + A1:2016.

The Post tensioning kit is comprised of the following components:

Macalloy 1030 Post Tensioning System Anchorage Components

Tensile element	Plain bar: prEN 10138-4-Y-1030-H-25,0/40,0-P Ribbed bar: prEN 10138-4-Y-1030-H-25,0/50,0-R (cold rolled thread)
Coupling	Steel fixed threaded coupling device.
Anchorage	Square steel anchor plate with an unthreaded hole, washer and nut.
Bursting reinforcement*	Additional reinforcement placed in the anchorage zone complying with EN 10080.
Ducts*	Steel strip ducts complying with EN 523 Corrugated plastic ducts in accordance with Fib Bulletin 75 Chapter 9
Filling material*	Cementitious Grout complying with EN 447 or EAD 160027-00-0301 Wax or grease complying with EAD 160027-00-0301

* Not supplied with the kit by the ETA holder

Table 1 Anchorage Components

The components of the kit have the same characteristics and geometry as the kit of ETA – 07/0046 issued by CARES in May 2012

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use

The Post – Tensioning system is intended for the use of prestressing of concrete structures of normal weight concrete.

The Bonded and Unbonded Macalloy 1030 Post-Tensioning Systems are assumed to be used for:

1. The prestressing of structures of normal-weight concrete and composite structures with Internal unbonded tendons
2. The prestressing of structures of normal-weight concrete and composite structures with Internal bonded tendons

1.2.2 General Assumptions

The manufacturer has provided the necessary installation instructions as detailed in the attached ANNEX D. Adherence to these instructions are essential to ensure the maintenance of performance and working life of the system.

1.2.3 Assumed working life

The provisions made in this ETA are based on an assumed intended working life of 100 years for permanent corrosion protection, subject to appropriate installation.

The assumed intended working life cannot be interpreted as a guarantee given by the manufacturer or Approval Body but is to be regarded as a means for choosing appropriate components and materials in relation to the expected, economically reasonable working life of the construction works.

2. Essential characteristics and relevant assessment methods and criteria

2.1 Essential characteristics of the product

2.1.1 Anchorages

The anchorages consist of steel square end plates, washers and nut. Details are given in Annex A.

2.1.2 Couplings

The couplers consist of steel tubes with an internal parallel thread. Details are given in Annex B.

2.1.3 Tendons

The tendons consist of plain and ribbed high tensile bars complying with prEN 10138-4-Y-1030-H and have the following properties:

Diameter mm	25	26.5	32	36	40	50*
Characteristic value of maximum force kN	506	569	828	1049	1295	2022
Maximum prestress force	405	454	662	834	1035	1618
* prEN 10138-4-Y-1030-H-50,0-R only (ribbed)						

Table 2 Tendon properties

2.1.3.1 Tendon elongation under load

The following information can be used to calculate the tendon elongation under load $0.7f_{pk}$ to $0.75f_{pk}$.

Bar secant Modulus of Elasticity ($0.05f_{pk}$ to $0.7f_{pk}$) = 170 GPa approximately.

Bar Modulus of Elasticity within elastic range = 182 GPa approximately.

Typical displacement at fixed anchorage = 1.5mm – 2.0mm.

Typical displacement at coupler = 1mm.

2.1.3.2 Losses at load transfer from jack to anchorage

Diameter (mm)	25 – 36 inclusive	40 – 50 inclusive
*Single stress	1.5 mm	2 mm
*Two or more stressing cycles.	0.6 mm	0.7 mm
*when loaded to $0.7 f_{pk}$ to $0.75 f_{pk}$		

Table 3 Losses at load transfer from jack to anchorage

2.1.4 Friction loss

2.1.4.1 Friction in the jacks

All jacks supplied by Macalloy Ltd are calibrated against a master gauge before despatch and the loads exerted by the ram are tabulated against the pressure gauge readings. Any friction on the jack is therefore allowed for if the calibration readings are used to control the applied load.

Electrical or mechanical load cells are available for the recalibration of jacks and gauges on site, or to control loading with greater accuracy than that provided by commercial pressure gauges.

Loads calculated from pressure gauge readings based on the jacks ram areas do not include an allowance for friction in the jack. Values should be obtained from the jack supplier.

2.1.4.2 Friction in the anchorage

There is no friction loss in single bar anchorages

2.1.4.3 Friction due to variations in the duct profile or wobble of the duct

Eurocode 2, EN 1992-1-1: 2004, as described below.

$$\Delta P_{\mu}(x) = P_{\max}(1 - e^{-\mu \cdot kx})$$

where:

$\Delta P_{\mu}(x)$ (kN) is the loss of load due to friction at distance x from the anchorage.

$P_{\max}$ (kN) is the prestressing force immediately after the anchorage (i.e. at distance $x=0$).

μ is the coefficient of friction between bar and duct.

$\mu = 0.33$ for smooth bars (unthreaded).

$\mu = 0.65$ for fully threaded bars.

k (rad/m) is the unintentional angular displacement per unit length.

The value of k is greater than 0.005 and less than 0.01.

x (m) is the distance along the tendon from where the prestressing force is at a maximum (i.e. distance from P_0).

2.1.4.4 Friction due to curvature of the tendon profile

Macalloy 1030 bars are designed to be used as straight bars / tendons. There is therefore no friction loss due to curvature of the tendon profile, when the tendon is placed straight. Unintentional variations in the tendon profile can be assumed to be in the range 0.005 to 0.01 radians per metre.

Losses as a result of unintentional variations in the tendon profile can be calculated as above.

2.1.4.5 Minimum radius of curvature

Macalloy 1030 bars are designed to be used as straight bars / tendons.

2.1.5 Anchorages

2.1.5.1 Anchorage spacing and edge distance

The minimum anchorage spacing and edge distance are specified in Annex C.

2.1.5.2 Concrete strength

The minimum concrete strength is f_{cm} , 0, cube = 35MPa in accordance with EN 206-1:2013 + A1:2016.

2.1.5.3 Concrete Cover

The concrete cover of the tendon may under no circumstances be less than 20mm or smaller than the concrete cover of the reinforcement installed in the same cross section. The respective standards and regulations on concrete cover valid at the place of use should be considered.

2.1.5.4 Essential characteristics related to dangerous substances.

The Macalloy 1030 Post Tensioning bar system is in Category S/W3: Product with no contact to and no impact on soil-, ground- and surface water

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Assessment of the performance of the post-tensioning system part of this document for the intended use in the sense of basic requirement for construction work 1 (mechanical resistance and stability) and for basic requirement for construction work 3 (hygiene, health and environment) has been made in accordance with EAD160004-00-0301 "Post Tensioning Kits for Prestressing of Structures", based on the provisions of all systems.

2.2.1 Reaction to fire

Classified: Class A1 (by definition as per section 2.2.35 of EAD 160004-99-0301).

2.2.2 Resistance to fire

No aspect of performance relevant to this essential requirement.

2.2.3 Content, emission and/or release of dangerous substances

According to the manufacturer's declaration the PT system does not cause harmful emissions of toxic gases, dangerous particles or radiation to the indoor environment nor contamination of the outdoor environment (air, soil, water).

2.2.4 Sustainable use of natural resources

No aspect of performance relevant to this essential requirement.

2.3 Criteria for the determination of the product-type(s)

The assessment of the fitness of the Macalloy 1030 Unbonded and Bonded bar Post tensioning System for the intended use in relation to the requirements for mechanical resistance and stability as per essential requirement 1 has been made in compliance with Annex A of EAD160004-00-0301 “Post Tensioning Kits for Prestressing of Structures”

This European Technical Assessment for the post-tensioning system is issued on the basis of agreed data, deposited at UK CARES, which identifies the post-tensioning system that has been assessed and judged.

Table 4 – Performance of the system BWR1

Product-type: Post-Tensioning Kit		Intended use: For the prestressing of structures	
Basic requirements for construction work	Essential characteristic	Performance	
[1] Mechanical resistance and stability	Resistance to static load	Satisfaction of acceptance criteria of EAD 160004-00-0301, Clause 2.2.1	
	Resistance to fatigue	Satisfaction of acceptance criteria of EAD 160004-00-0301, Clause 2.2.2.	
	Load transfer to the structure	Satisfaction of acceptance criteria of EAD 160004-00-0301, Clause 2.2.3.	

Table 5 – Performance of the system BWR3

Product-type: Post-Tensioning Kit		Intended use: For the prestressing of structures	
Basic requirement for construction work	Essential characteristic	Performance	
[3] Hygiene, health and environment	Release of dangerous substances	PT system does not cause harmful emission of toxic gases, dangerous particles or radiation to the indoor environment nor contamination of the outdoor environment (air, soil, water)	

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

BWRs 2, 4, 5, 6 and 7 are not relevant according to EAD160004-00-0301.

3. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

The system of attestation of conformity specified by the European Commission in mandate 98/456/EC is system 1+, with audit testing of samples, described in Council Directive (89/106/EEC) Annex III and is detailed as follows:

a) Tasks for the manufacturer

(1) Factory production control

(2) Further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

(b) Tasks for the Approved Body:

(1) Initial type testing of the product.

(2) Initial inspection of factory and of factory production control (FPC).

(3) Continuous surveillance, assessment and approval of factory production control (FPC).

(4) Audit testing of samples.

3.2 Tasks of the manufacturer

Factory production control

In accordance with EAD160004-00-0301 clause 3.2, the manufacturer shall implement a quality management system complying with EN ISO 9001, including a quality plan that addresses the FPC requirements of EAD160004-00-0301.

The quality plan shall specifically ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product.

The manufacturer shall evaluate and select suppliers based on their ability to supply product in accordance with the manufacturer's requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained.

In accordance with EN ISO9001, the manufacturer shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process in accordance with the following test plan (Table 6).

Evidence of conformity with the test plan shall be maintained and shall indicate the person(s) authorizing release of product.

Product release and service delivery shall not proceed until the planned arrangements have been satisfactorily completed

Table 6 Control plan for the manufacturer; corner stones

No	Subject/type of control (product, raw/constituent material, component - indicating characteristic concerned)	Test or control method (refer to 2.2 or 3.4)	Criteria, if any	Minimum number of samples	Minimum frequency of control
(1)	(2)	(3)	(4)	(5)	(6)
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]*					
1	Bearing plate material	Checking of relevant certificate ¹⁾		100%	Continuous
	Bearing plate dimensions	Testing		3% with a minimum of 2 specimens	Continuous
	Bearing plate visual inspection	Testing		100%	Continuous
	Bearing plate traceability	Bulk			
2	Nut, washer and coupling material	Checking of relevant certificate ³⁾	²⁾	100%	Continuous
	Nut, washer and coupling treatment hardness	Testing	²⁾	0.5% with a minimum of 2 specimens	Continuous
	Nut, washer and coupling detailed dimensions	Testing	²⁾	5% with a minimum of 2 specimens	Continuous
	Nut, washer and coupling visual inspection	Checking	²⁾	100%	Continuous
	Nut, washer and coupling traceability	Full			
3	Tensile element (bar) material	Checking	²⁾	100%	Continuous
	Tensile element (bar) diameter	Testing	²⁾	1 sample	each coil or every 7 tonnes ⁴⁾
	Tensile element (bar) visual inspection	Checking	²⁾	1 sample	each coil or every 7 tonnes ⁴⁾
	Tensile element (bar) thread form	Checking	²⁾	1 sample	each coil or every 7 tonnes ⁴⁾
Key 1) The certificate is at least a test report 2.2 according to EN 10204. 2) Conformity with the specifications of the components 3) The certificate is an inspection report 3.1 according to EN 10204 4) Maximum between a coil and 7 tons has to be taken into account					

Traceability

full : Full traceability of each component to its raw material.

bulk : Traceability of each delivery of components to a defined point.

Material: Defined according to technical specification deposited by the supplier

Detailed dimension: Measuring of all the dimensions and angles according to the specification given in the test plan

Visual inspection: Main dimensions, correct marking and labelling, surface, corrosion, coating, etc.

Treatment hardness: surface hardness, core hardness and treatment depth (if applicable)

3.3 Tasks of the notified body

3.3.1 Initial type-testing of the product

The results of the tests performed as part of the initial assessment for this European Technical Approval may be used unless there are changes in the manufacturing process or plant. In such cases, the necessary initial type-testing shall be agreed between the manufacturer and the approved body involved.

3.3.2 Initial inspection of factory and of factory production control

The approved body shall audit the manufacturer's factory production control system including the prescribed test plan (Table 7) to ensure that the PT system complies with this ETA.

3.3.3 Continuous surveillance

The approved body shall audit the manufacturer's factory production control system including the prescribed test plan (Table 7) at least once a year to ensure that the PT system continues to comply with this ETA.

3.3.4 Audit testing of samples

The approved body shall select component samples during surveillance audits and check for compliance with the above test plan (Table 7).

3.3.5 Certification

The approved body shall issue a certificate of product conformity as evidence of compliance with this ETA.

3.3.6 CE marking

The CE marking shall be affixed to the delivery note.

The CE mark shall be accompanied by the following information:

- Name or identifying mark of the producer and plant.
- The last two digits of the year in which the marking was affixed.
- The numbers of the certificates of conformity.
- The ETA number.
- The use categories.
- The number of the approved body involved.
- The product's identity (commercial name).

3.3.7 Withdrawal of certification

In cases where the provisions of the European Technical Assessment and the "Macalloy Works Factory Production Control Plan" are no longer fulfilled the notified body shall withdraw the certificate of conformity and inform the UK Certification Authority for Reinforcing Steels (CARES) without delay.

Table 7 Control plan for the notified body; corner stones

Initial inspection of the manufacturing plant and of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
No	Subject/type of control <i>(product, raw/constituent material, component - indicating characteristic concerned)</i>	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
1	FPC documentation system: procedures and technical forms	documents	check	all	
2	Records of the FPC documentation system	records	check	1 for type	
3	Factory organisation: qualifications, tasks and responsibilities of the technical and management staff	documents and records (3)	check	all	
4	Production flow	documents	check	all	
5	Order management: offer, order and accompanying documentation	documents	check	1	
6	Preparation of the Register of Manufacturer and the Declaration of Performance	documents	check	all	
7	Criteria, methods and records of materials internal controls and checks of the acceptance controls	documents and records	check	1 for type	
8	Production management (frequency, number and location of samples of finished products or components, periodic tests; identification systems products and their components; certifications of materials)	documents and records	check	1 for type	
9	Records of tests performed by the Manufacturer	records	check	all	
10	Inspection of production plants and warehouses	visual	check	all	
11	Manufacturer testing lab: check of critical equipment for the purpose of experimental measurements and / or controls; assurance metrological traceability of measurement and control equipment	visual, documents and records	check	all	
12	Treatment of non-conforming products, criteria for declassification and segregation	visual	check	1	
13	Traceability of products, from raw materials to the job site and vice versa	visual and records	check	1	

Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
No	Subject/type of control <i>(product, raw/constituent material, component - indicating characteristic concerned)</i>	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
1	FPC documentation system: procedures and technical forms	documents	check	modifications only	1/year
2	Records of the FPC documentation system	records	check	1 for type	1/year
3	Factory organisation: qualifications, tasks and responsibilities of the technical and management staff	documents and records	check	modifications only	1/year
4	Production flow	documents	check	modifications only	1/year
5	Register of Manufacturers	records	check	all	1/year
6	Records of audits of component manufacturers	records	check	all	1/year
7	Declaration of Performance	records	check	1	1/year
8	Order management: offer, order and accompanying documentation	records	check	1	1/year
9	Criteria, methods and records of materials internal controls and checks of the acceptance controls	records	check	1	1/year
10	Production management (frequency, number and location of samples of finished products or components, periodic tests; identification systems products and their components; certifications of materials)	records	check	1 for type	1/year
11	Records of tests performed by the Manufacturer	records	check	1	1/year
12	Inspection of production plants and warehouses	visual	check	all	1/year
13	Manufacturer testing lab: check of critical equipment for the purpose of experimental measurements and / or controls; assurance metrological traceability of measurement and control equipment	visual and records	check	all	1/year
14	Treatment of non-conforming products, criteria for declassification and segregation	visual and records	check	1	1/year
15	Traceability of products, from raw materials to the job site and vice versa	visual and records	check	1	1/year

Audit-testing of samples taken before placing the product on the market <i>(for system 1+ only)</i>					
No	Subject/type of control <i>(product, raw/constituent material, component - indicating characteristic concerned)</i>	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
1	Bearing plate material	Checking and testing (hardness and chemical)	²⁾	1	1/year
	Bearing plate detailed dimensions	testing	²⁾	1	1/year
	Bearing plate visual inspection	checking	²⁾	1	1/year
2	Nut, washer and coupling material	Checking and testing (mechanical and chemical)	²⁾	2	1/year
	Nut, washer and coupling treatment hardness	Checking and testing (hardness profile)	²⁾	2	1/year
	Nut, washer and coupling detailed dimension	Testing	²⁾	1	1/year
	Nut, washer and coupling main dimensions, surface hardness	Testing	²⁾	5	1/year
	Nut, washer and coupling visual inspection	checking	²⁾	5	1/year
3	Single tensile element test	Annex C.7	Annex C.7	9	1/year
Key 1) If the kit comprises different types of anchor heads e.g. with different materials, different shape, different wedges, etc., then the number of samples are understood as per type. 2) Conformity with the specifications of the components 3) Requirements and points to check are the following : Technical staff: qualified staff that passed at least an internal training for the tasks Laboratory staff for FPC with passed internal and external qualifications Clear and reasonable system of tasking and supervising, documented; recognizable responsibilities					

4. Reference documents

EN 1992-1-1: 2004 Eurocode 2: Design of concrete structures

prEN 10138-4: 2000 Prestressing steels – Part 4: Bars

BS EN ISO9001:2008 Quality Management Systems. Requirements (Valid until September 2018)

BS EN ISO9001:2015 Quality Management Systems. Requirements

EN 10080: 2005 Steel for the reinforcement of concrete – Weldable reinforcing steel

EN 10025: 2004 Hot rolled products of structural steels

EN 523: 2003 Steel strip sheaths for prestressing tendons - Terminology, requirements, quality control

EN 10255:2004 Non-alloy steel tubes suitable for welding or threading,

EN 524: 1997 – Parts 1 to 6: Steel strip sheaths for prestressing tendons - Test methods

- Part 1: Determination of shape and dimensions;
- Part 2: Determination of flexural behaviour;
- Part 3: To and fro bending test;
- Part 4: Determination of lateral load resistance;
- Part 5: Determination of tensile load resistance;
- Part 6: Determination of leak tightness (Determination of water loss)

EN 445:2007 Grout for prestressing tendons, Test methods

EN 446:2007 Grout for prestressing tendons, Grouting procedures

EN 447: 2007 Grout for prestressing tendons, Specifications for common grout

EN 934-4:2009 Admixtures for concrete, mortar and grout: Admixtures for grout for prestressing tendons – Definitions, requirements and conformity

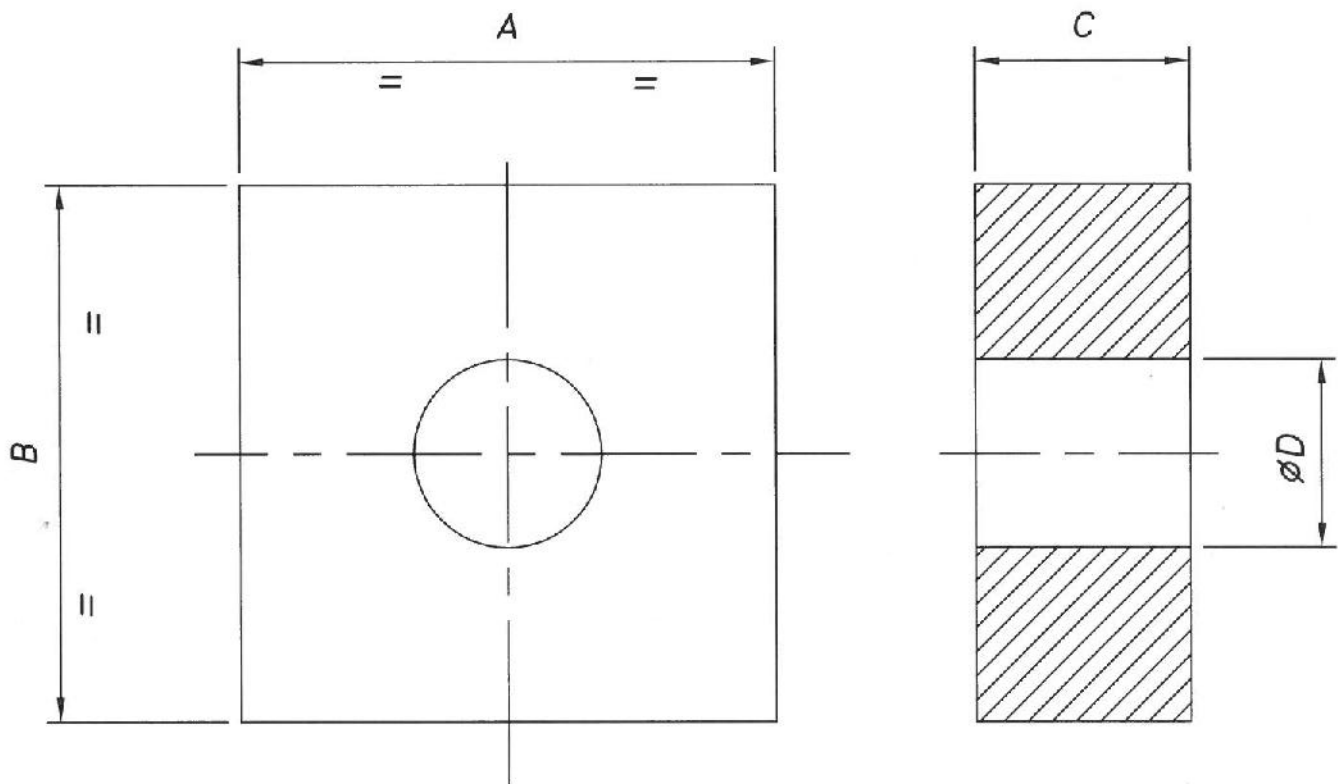
EN ISO 1461: 2009 Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods

EN 10204:2004 Metallic products; type of inspection documents

EN 206-1:2013 + A1:2016 Concrete – Part 1: Specification, performance, production and conformity

EAD160004-00-0301: September 2016 – European Assessment Document for Post Tensioning Kits for Prestressing of Structures.

ANNEX A – ANCHORAGE DRAWINGS



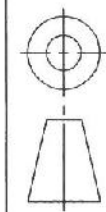
MATERIAL: BS. EN 10025 S355J2
(EQUIV): BS. 4360 GRADE 50B

NOM. DIA.	REFER.	A	B	C	ϕD
25	FPP 25	100 ± 3	100 ± 3	40 ± 1	34 ± 1
26.5	FPP 26.5	110 ± 3	110 ± 3	40 ± 1	36 ± 1
32	FPP 32	125 ± 3	125 ± 3	50 ± 2	41 ± 1
36	FPP 36	140 ± 3	140 ± 3	50 ± 2	45 ± 1
40	FPP 40	160 ± 3	160 ± 3	60 ± 2	51 ± 1
50	FPP 50	200 ± 3	200 ± 3	60 ± 2	61 ± 1
75*	FPP 75	300 ± 3	300 ± 3	75 ± 2	82 ± 1

*NOT COVERED BY ETA APPROVAL

D	SA	261114	MATERIAL UPDATED TO J2
C	NMW	110806	40 ϕ (A) CHANGED FROM 150, 40 ϕ , 50 ϕ & 75 ϕ (B) CHANGED FROM 150, 175 & 250 RESPECTIVELY
B	PM	091299	40 ϕ (ϕD) CHANGED FROM 52
A	PM	031199	ϕD FOR 25MM BAR CHANGED
			TOLERANCE ON DIMENSION 'D' CHANGED

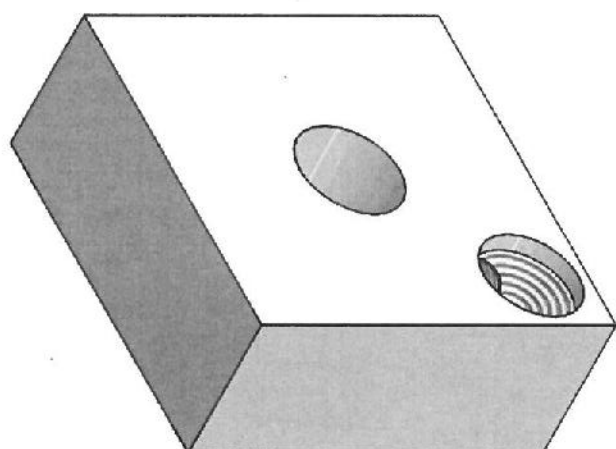
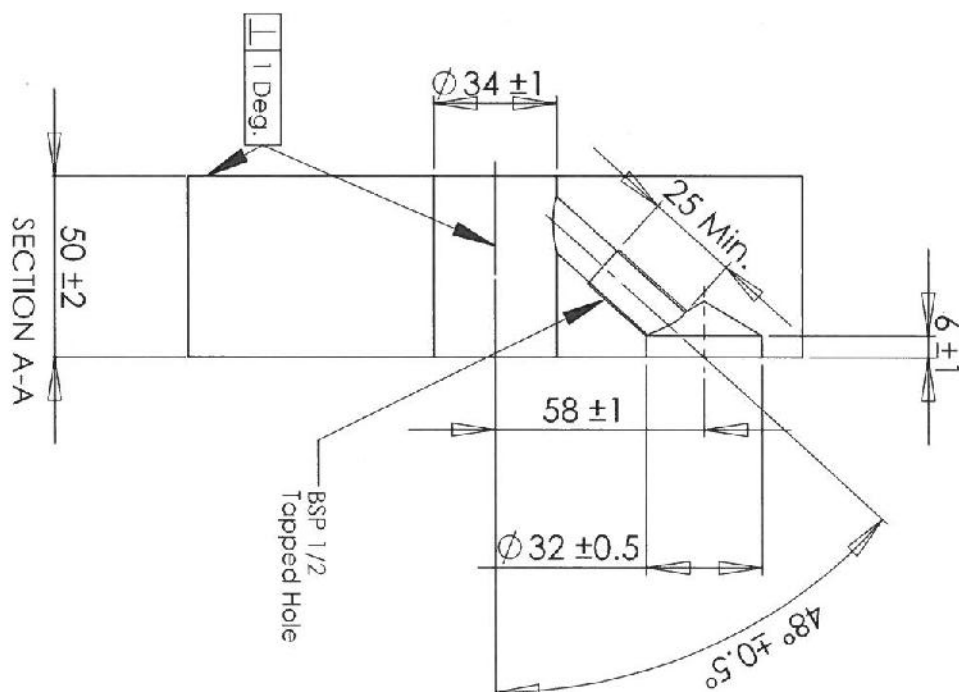
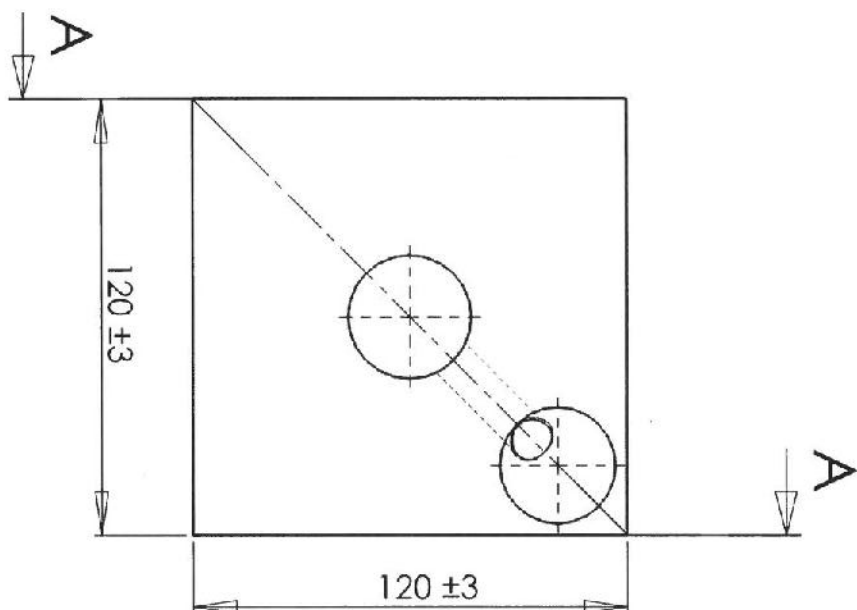
REV	INIT.	DATE	DESCRIPTION
TITLE STANDARD END PLATE FOR MACALLOY BARS			
McCalls Special Products Ltd. Caxton Way Dinnington S25 3QE TEL: 01909 519200 FAX: 01909 519201 Macalloy Bar Systems			
DESIGNED	P. MOCKFORD	DATE	JUNE, 98
DRAWN	K.G. BAMBRIDGE	DATE	JUNE, 98
CHECKED	C. JAYEOBA	DATE	SEPT, 16
SCALE		FILE No.	
DRG. No.			FPP 25-75
			REV D



DO NOT SCALE OFF DRAWING

IF IN DOUBT ASK

CREATED USING SOLIDWORKS

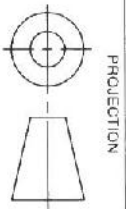


MATERIAL:
GRADE S355 J2 TO EN 10025-2:2004

THREADS:
EN ISO 228:2003

Component Weight: 5.17 kg

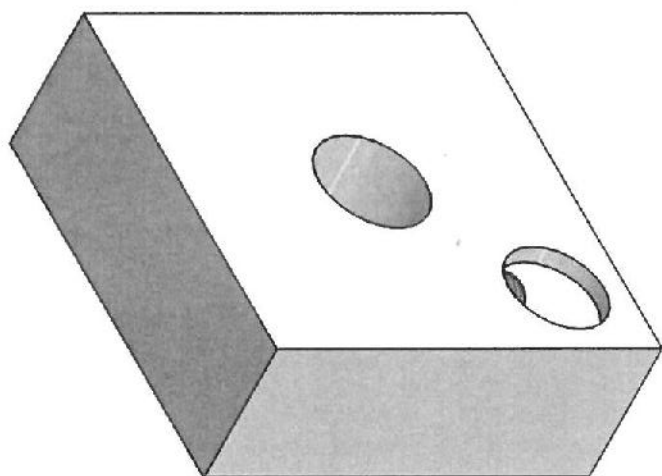
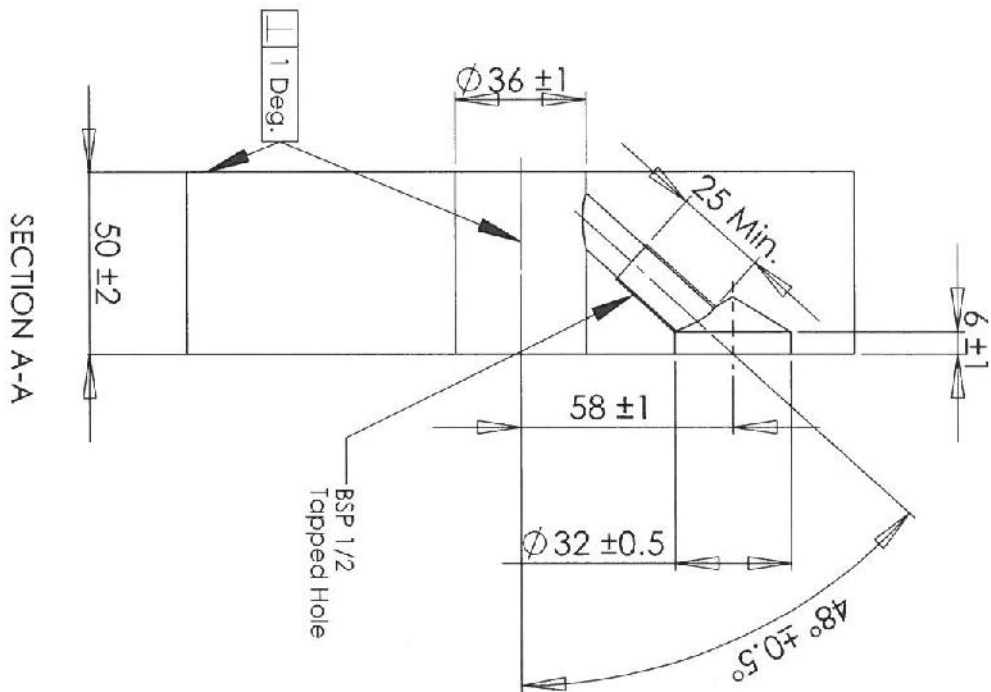
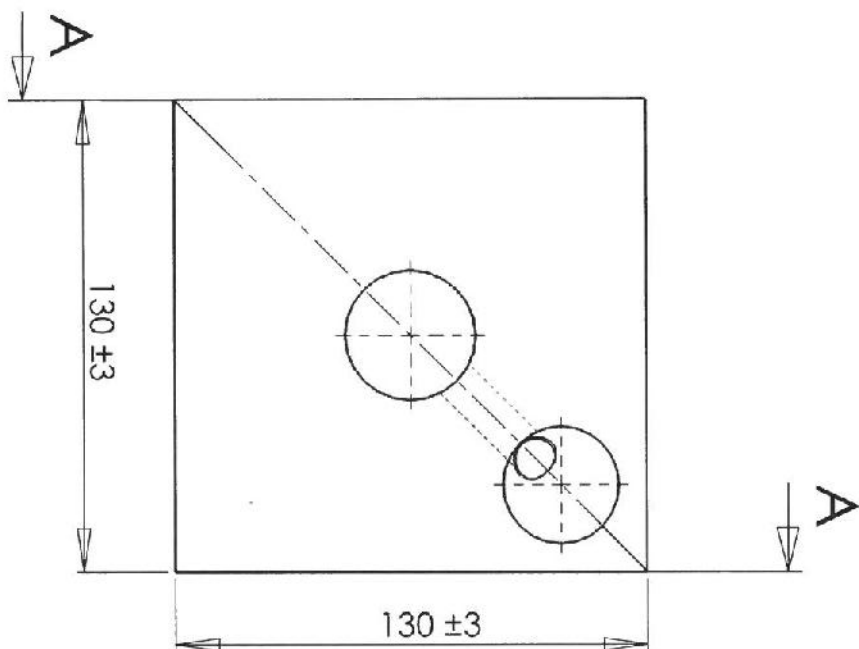
REV	A	DATE	26.11.14	DESCRIPTION	MATERIAL UPDATED TO J2
	INIT.	DATE			
This drawing is a private communication and the property of MACALLOY Ltd. It must not be copied or loaned without the consent of MacCall's Special Products and must be returned.					
TITLE END PLATE WITH GROUT HOLE FOR 25mm MACALLOY 1030 BAR					
DESIGNED		D WILLIAMS		DATE 25/02/2003	
DRAWN		A SHAHIN		DATE 30/01/2014	
CHECKED		C. J. J. J.		DATE 21/09/2017	
SCALE		1:2		LOCATION	
MACALLOY LTD CAYTON WAY DUNNINGTON S25 3OE TEL: 01909 519200 FAX: 01909 519201					
DWG. No. FPGP 25 Rev A					
Bar Systems					
Macalloy					
REV A					



DO NOT SCALE OFF DRAWING

IF IN DOUBT ASK

CREATED USING SOLIDWORKS



Component Weight: 5.61 kg

MATERIAL:
GRADE S355 J2 TO EN 10025-2:2004
THREADS:
EN ISO 228:2003

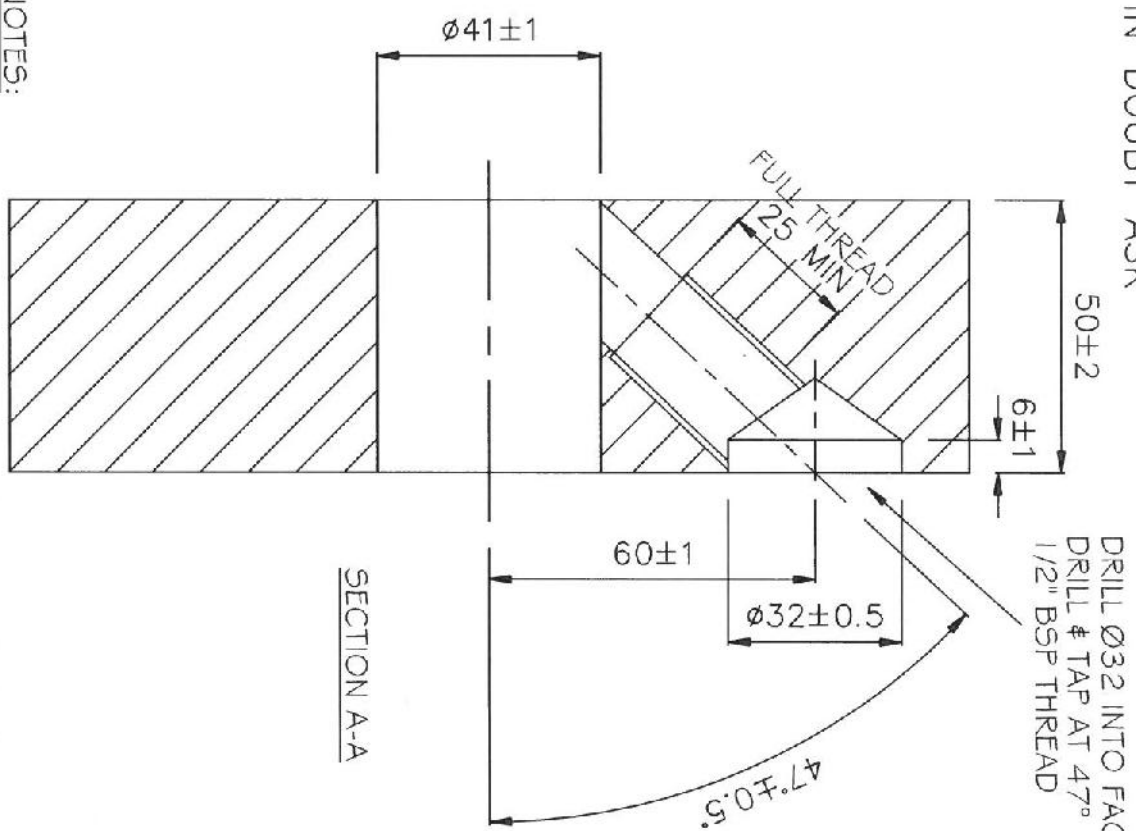
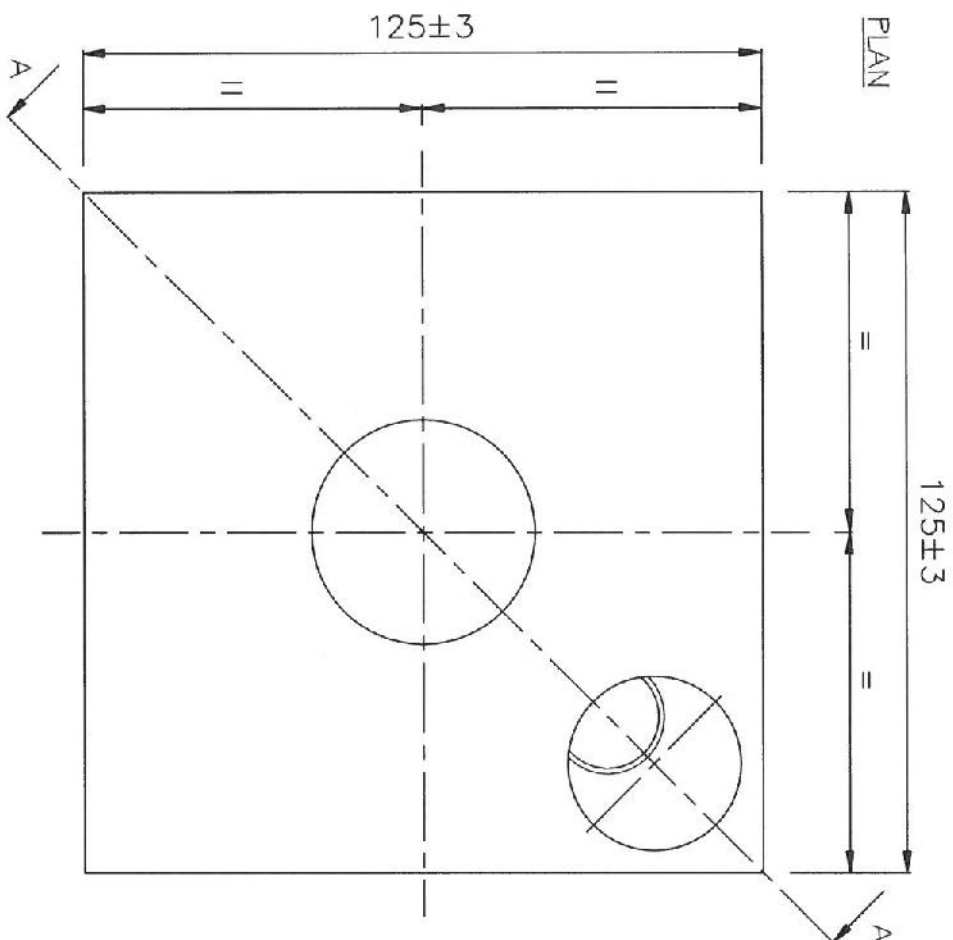
			TITLE			END PLATE WITH GROUT HOLE FOR 26.5MM MACALLOY 1030 BAR			MACALLOY LTD CAXTON WAY DUNNINGTON S25 3OE TEL: 01909 519200 FAX: 01909 519201									
A	S.A	28.11.14	MATERIAL UPDATED TO J2			DESIGNED	D WILLIAMS	DATE	25/02/2009	DATE	30.03/2014	DATE	21/08/2017	LOCATION	DRG. No.	FPGP 26.5 Rev A	REV	A
REV	INIT.	DATE	DESCRIPTION			DRAWN	A SHAHIN	CHECKED	<i>guy sja</i>	SCALE	1:2							
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DO NOT SCALE OFF DRAWING

IF IN DOUBT ASK



MATERIAL:
GRADE S355 J2 TO EN 10025: 2004

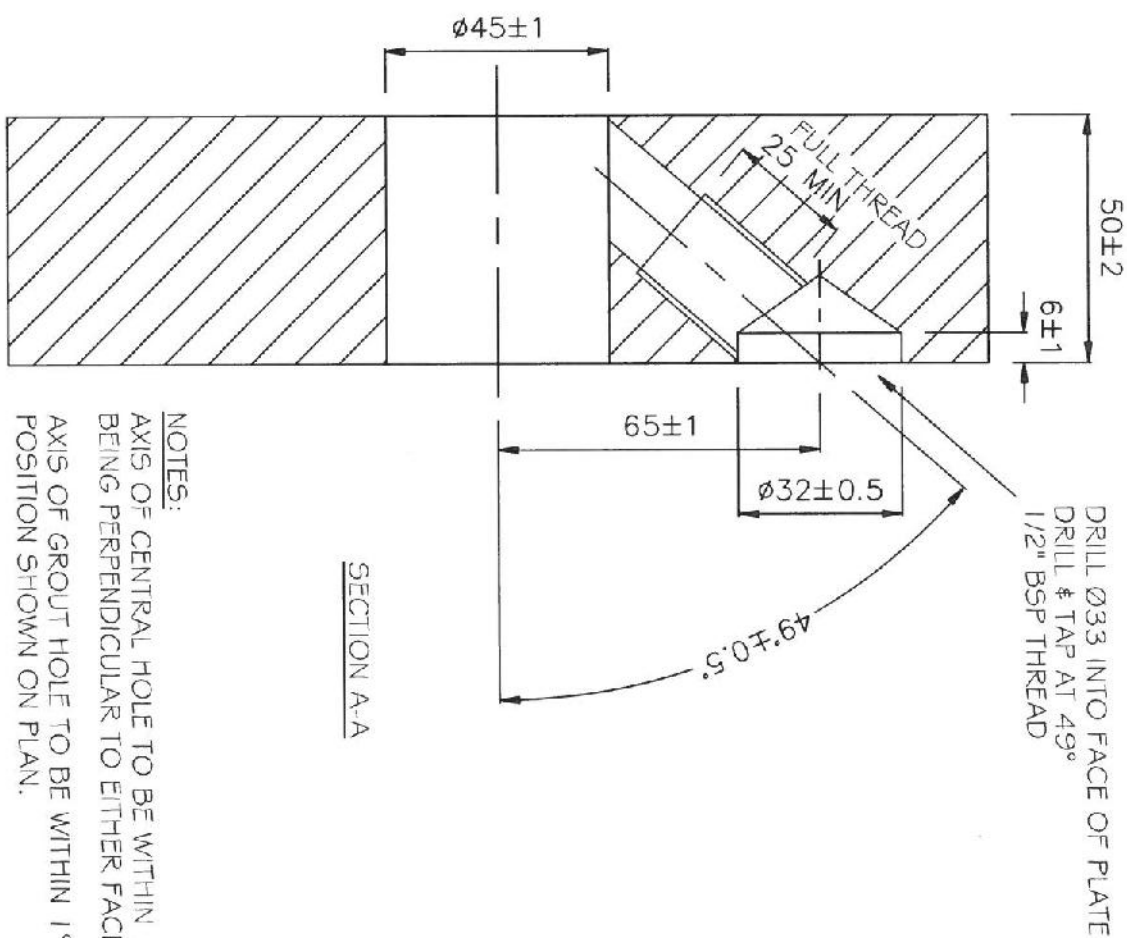
THREADS:
EN ISO 228: 2003

NOTES:  AXIS OF CENTRAL HOLE TO BE WITHIN 1° OF BEING PERPENDICULAR TO EITHER FACE. AXIS OF GROUT HOLE TO BE WITHIN 1° OF POSITION SHOWN ON PLAN.

© This drawing is a private communication and the property of MACALLOY LTD. It must not be copied or loaned without the consent of Macalloy Special Products and must be returned.	REV	INIT.	DATE	DESCRIPTION	TITLE END PLATE WITH GROUT HOLE FOR 32mm MACALLOY 1030 BAR		MACALLOY LTD CAXTON WAY DINNINGTON S25 3OE TEL: 01909 519200 FAX: 01909 519201 Macalloy is a registered trademark and trading name of Macalloy Special Products Ltd.	
	A	S.A	26.11.14	MATERIAL UPDATED TO J2	DESIGNED	MACALLOY		
					DRAWN	R GOODMAN		
					CHECKED	C JAYEOBA		
				SCALE		DATE	JUNE 07	
						DATE	JUNE 07	
						FILE No.	SEPT 16	
								DRG. No. FPGP 32



IF IN DOUBT ASK



NOTES:

AXIS OF CENTRAL HOLE TO BE WITHIN 1° OF BEING PERPENDICULAR TO EITHER FACE.

AXIS OF GROUT HOLE TO BE WITHIN 1° OF POSITION SHOWN ON PLAN.

SECTION A-A

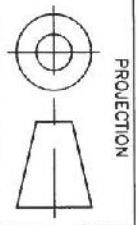
Macalloy

Flow Systems

MACALLOY LTD
CAXTON WAY
DINNINGTON S25 3QE
TEL: 01909 519700
FAX: 01909 519201

Macalloy is a registered trademark and trade name of Macalloy Special Products Ltd.

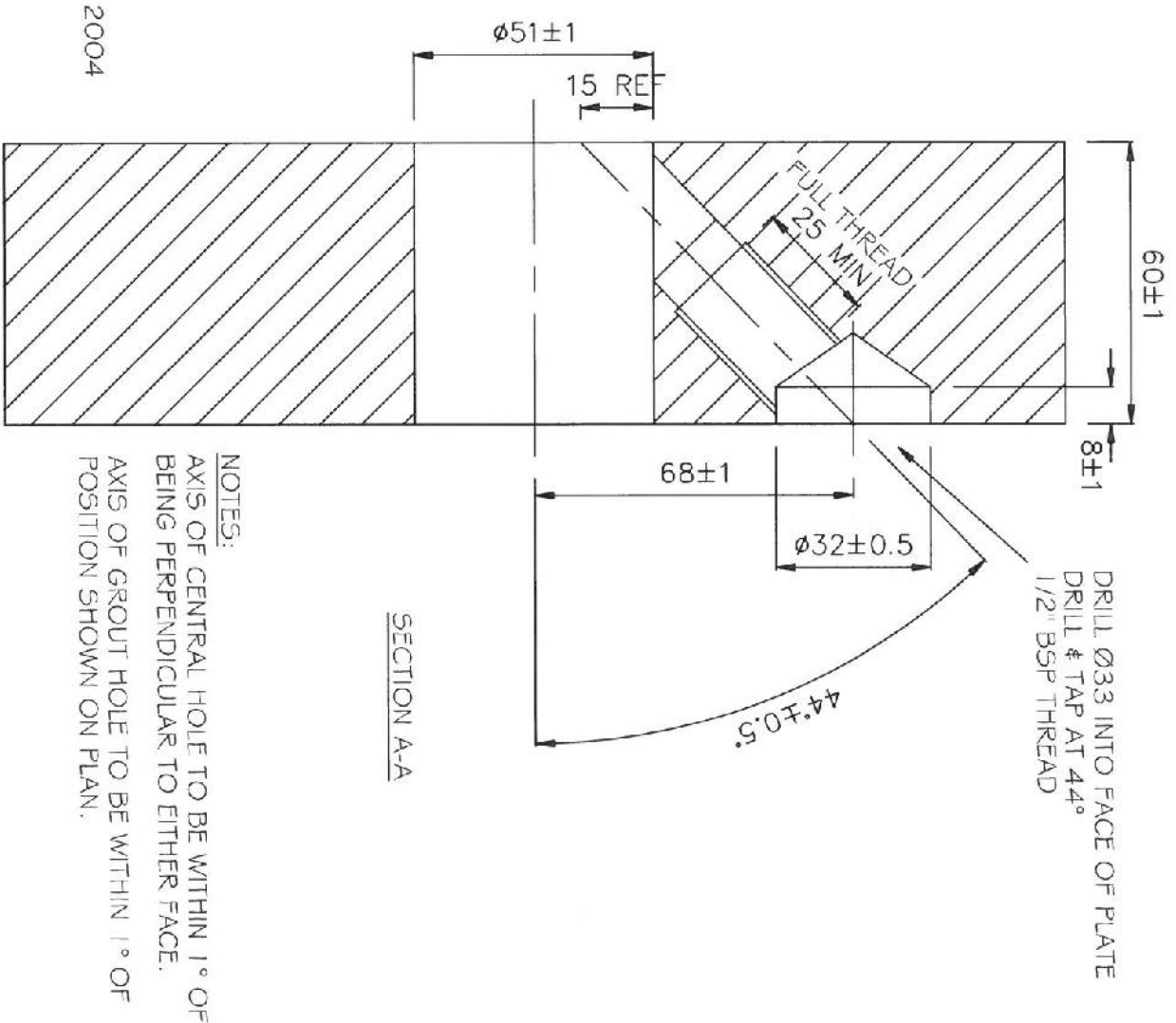
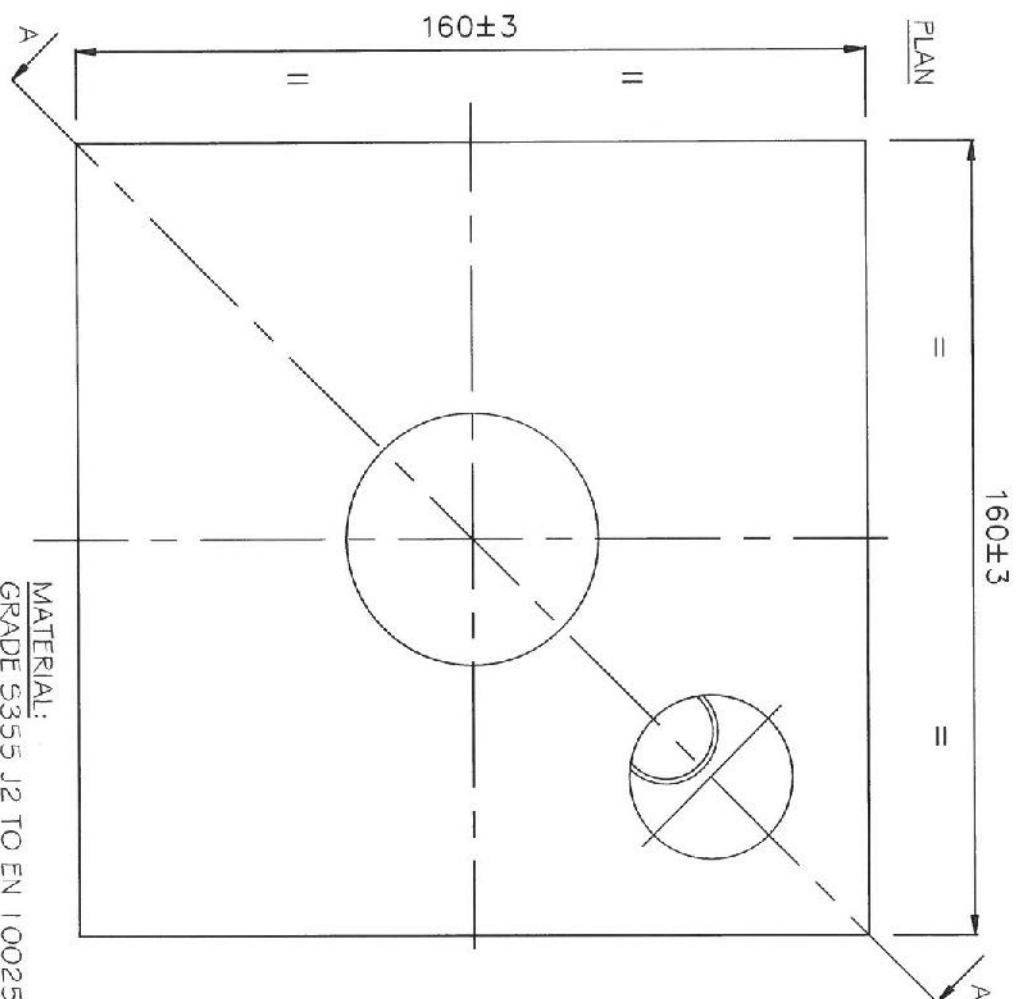
DWG. No. FPGP 36 REV A



PROJECTION

DO NOT SCALE OFF DRAWING

IF IN DOUBT ASK



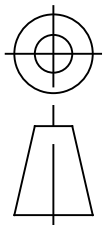
NOTES:
 AXIS OF CENTRAL HOLE TO BE WITHIN 1° OF
 BEING PERPENDICULAR TO EITHER FACE.
 AXIS OF GROUT HOLE TO BE WITHIN 1° OF
 POSITION SHOWN ON PLAN.

SECTION A-A

MATERIAL:
 GRADE S355 J2 TO EN 10025: 2004
 THREADS:
 EN ISO 228: 2003

D	SA	261114	MATERIAL UPDATED TO J2 GROUT HOLE DETAILS CHANGED TO MIRROR MANUFACTURED ITEM. THREAD SPEC INCLUDED. SIZE OF PLATE CHANGED FROM 150x150. HOLE REDUCED FROM #52 MAIN HOLE TOL CHANGED TO ALLOW FOR FLAME CUTTING.
	RC	050707	
	NW	180106	
	PM	031199	
REV	INIT.	DATE	DESCRIPTION
1	SA	261114	MATERIAL UPDATED TO J2
2	RC	050707	GROUT HOLE DETAILS CHANGED TO MIRROR MANUFACTURED ITEM. THREAD SPEC INCLUDED.
3	NW	180106	SIZE OF PLATE CHANGED FROM 150x150. HOLE REDUCED FROM #52
4	PM	031199	MAIN HOLE TOL CHANGED TO ALLOW FOR FLAME CUTTING.
© This drawing is a private communication and the property of MACALLOY Ltd. It must not be copied or loaned without the consent of McCall's Special Products and must be returned.			
TITLE END PLATE WITH GROUT HOLE FOR 40mm MACALLOY 1030 BAR			
DESIGNED MACALLOY		DATE	JULY 07
DRAWN R GOODMAN		DATE	JULY 07
CHECKED <i>Chapman</i>		DATE	AUG 17
SCALE 1:1 WHEN PRINTED 1:1		FILE No.	N/A
MACALLOY LTD CAXTON WAY DUNNINGTON, S25 3QE TEL: 01909 519200 FAX: 01909 519201		DRG. No. FPGP 40	
Macalloy is a registered trademark and trading name of Macalloy Special Products Ltd.		REV D	

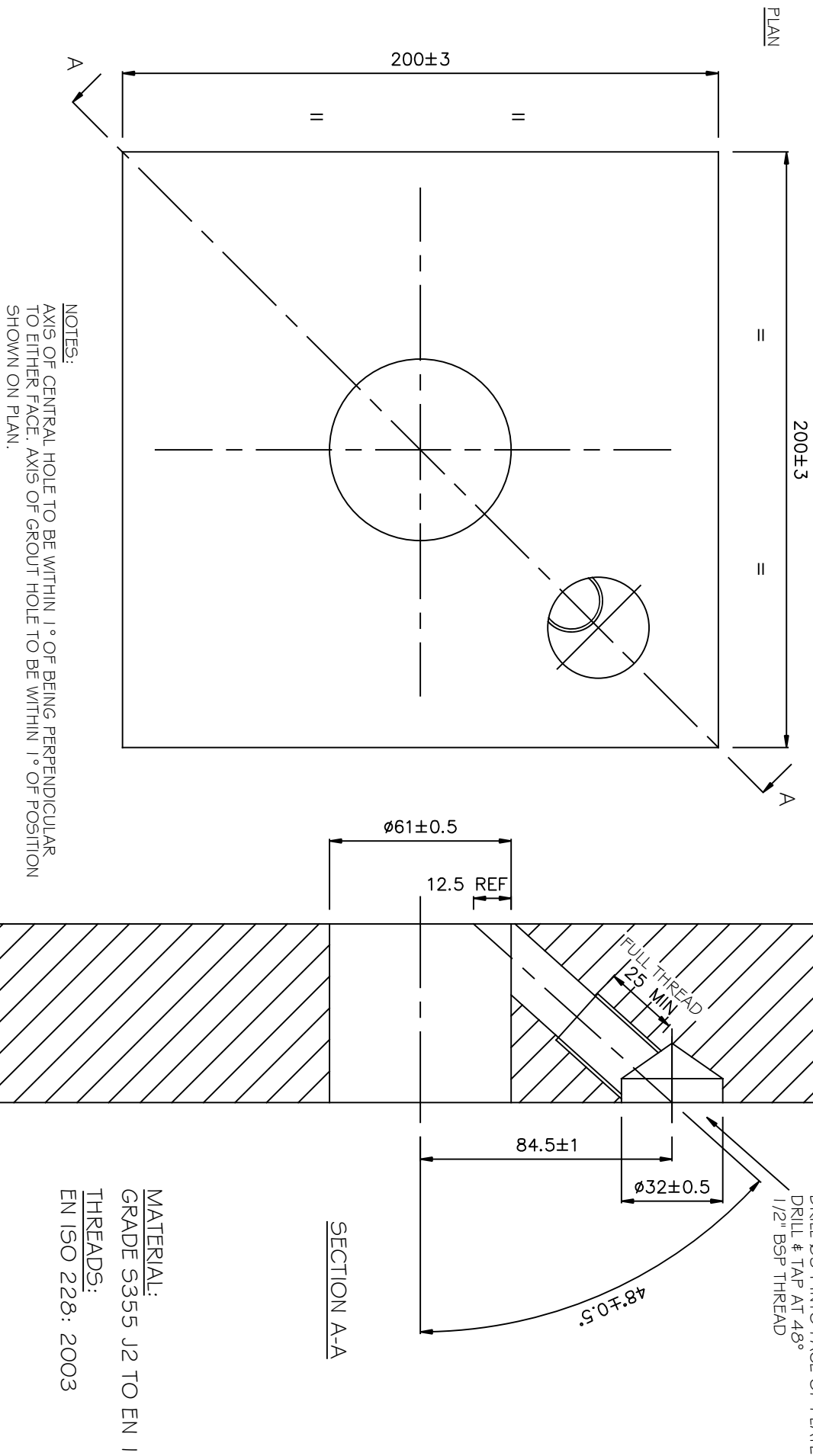
Macalloy



PROJECTION

DO NOT SCALE OFF DRAWING

IF IN DOUBT ASK



NOTES:
AXIS OF CENTRAL HOLE TO BE WITHIN 1° OF BEING PERPENDICULAR TO EITHER FACE. AXIS OF GROUT HOLE TO BE WITHIN 1° OF POSITION SHOWN ON PLAN.

MATERIAL:
GRADE S355 J2 TO EN 10025: 2004
THREADS:
EN ISO 228: 2003

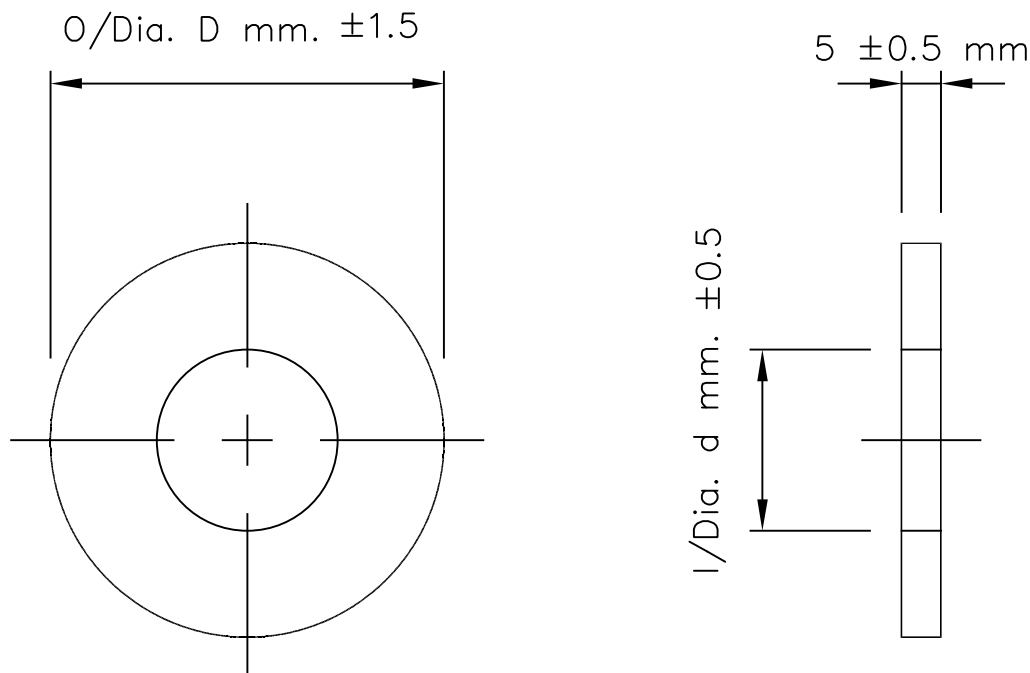
D	SA	261114	MATERIAL UPDATED TO J2
C	RG	050707	GROUT HOLE DETAILS CHANGED TO MIRROR MANUFACTURED ITEM. THREAD SPEC INCLUDED.
B	NW	180106	SIZE OF PLATE CHANGED FROM 200X200
A	PM	031199	MAIN HOLE TOL CHANGED TO ALLOW FOR FLAME CUTTING.
	REV	INIT	DATE
			DESCRIPTION

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TITLE			
END PLATE WITH GROUT HOLE FOR 50mm MACALLOY 1030 BAR			
DESIGNED	MACALLOY	DATE	JULY 07
DRAWN	R GOODMAN	DATE	JULY 07
CHECKED	C JAYEOBA	DATE	SEPT 16
SCALE	1:1 WHEN PRINTER	FILE No.	N/A

MACALLOY LTD CAYTON WAY DINNINGTON S25 3QE TEL: 01909 519200 FAX: 01909 519201
--

DRG. No.	FPGP 50	REV	D
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NOMINAL BAR DIAMETER mm	WASHER REFERENCE mm	OUTSIDE DIAMETER D mm	INSIDE DIAMETER d' mm
25	FSW 25	60	31
26.5	FSW 26.5	65	32
32	FSW 32	70	38
36	FSW 36	75	42
40	FSW 40	90	47
50	FSW 50	105	57

MATERIAL : GRADE S355JR TO EN 10025:2004
 MINIMUM YIELD STRESS: 450 N/mm^2
 MINIMUM ULTIMATE STRESS: 550 N/mm^2
 ROCKWELL: MIN. 10 (C SCALE)

MANUFACTURE : WASHERS MAY BE STAMPED OUT FROM
 STRIP OR PARTED OFF FROM BAR

H	CJ	240916	MATERIAL GRADE & HARDNESS REQUIREMENTS ADDED
G	PO	190313	REF. TO GRADE S355 REMOVED, ADDRESS UPDATED
E	RG	120706	40mm WASHER WAS 80 OD.
D	PM	200400	GRADE ADDED
C	PM	140497	LOGO CHANGE
B	PM	020795	FORMAT CHANGED N/mm^2 WAS N/m^2
	NP	161194	MATERIAL SPEC DESIGNATED

ETA 07/0046 of 29.11.18 Page 24 of 38

REV	INIT.	DATE	DESCRIPTION
TITLE MACALLOY WASHERS 25 DIA. ~ 50 DIA.			
DESIGNED	P. MOCKFORD	DATE	OCT, 93
DRAWN	K.G. BAMBRIDGE	DATE	OCT, 93
CHECKED	C. JAYEOBA	DATE	SEPT, 16
SCALE		FILE No.	

Macalloy
 Caxton Way, Dinnington
 Sheffield S25 3QE

TEL: 01909 519200
 FAX: 01909 519201

DRG. No.

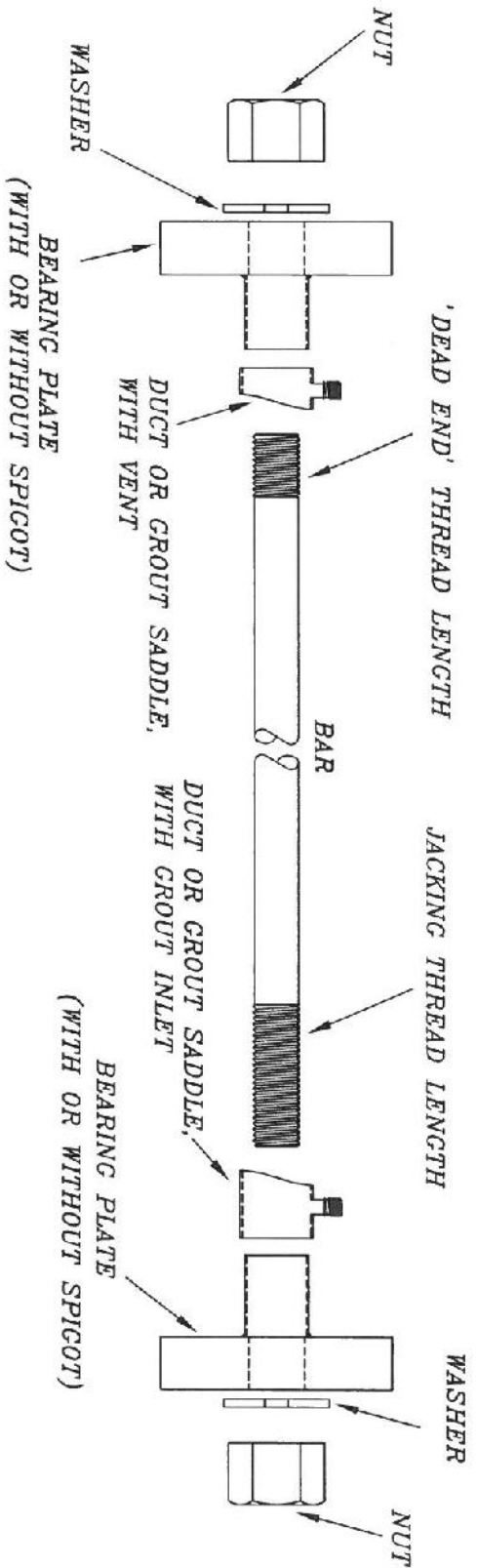
Macalloy

Bar Systems

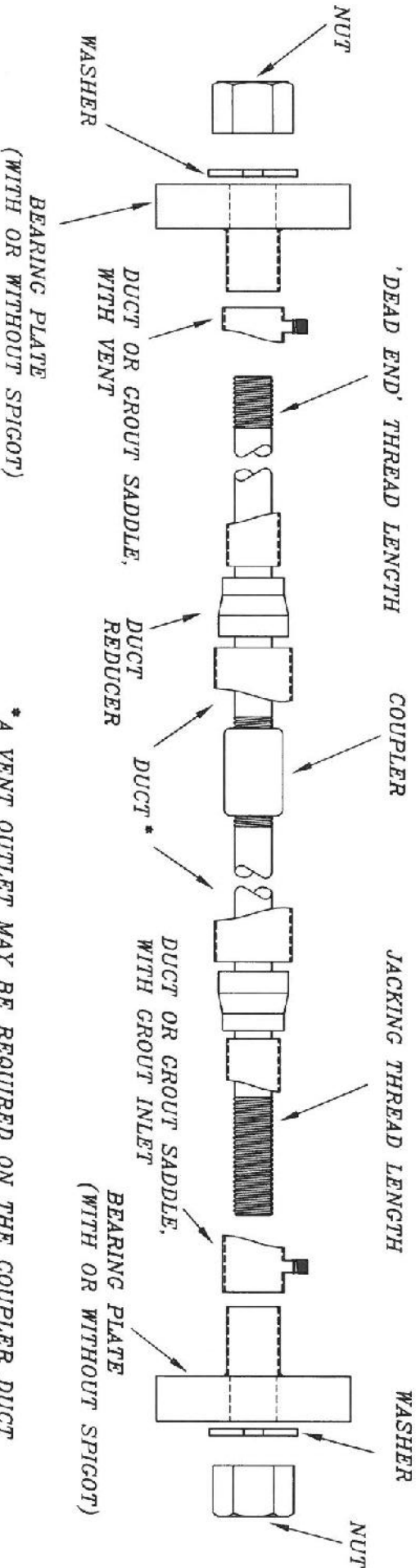
M/W/25-50

REV
H

TENDON WITHOUT COUPLER



TENDON WITH COUPLER



* A VENT OUTLET MAY BE REQUIRED ON THE COUPLER DUCT IF THE COUPLER DUCT IS OF A LONG LENGTH

REV	INIT.	DATE	DESCRIPTION	TITLE	DESIGNED	DRAWN	CHECKED	SCALE	FILE No.	MACALLOY LTD	DRG. No.	REV
				TYPICAL TENDON ASSEMBLY	MACALLOY	MACALLOY	MACALLOY	1:1	N/A	CAYTON WAY	GROUT 25 & 26.5	0
				25mm & 26.5mm BAR DIAMETER	JULY 2007	JULY 2007	AUG 2017			DINNINGTON S25 30E		
										TEL: 01809 519200		
										FAX: 01809 519201		
										MACALLOY IS A REGISTERED TRADEMARK AND TRADE NAME OF MACALLOY SPECIAL PRODUCTS LTD		
										(In S) 000000		
										Macalloy		

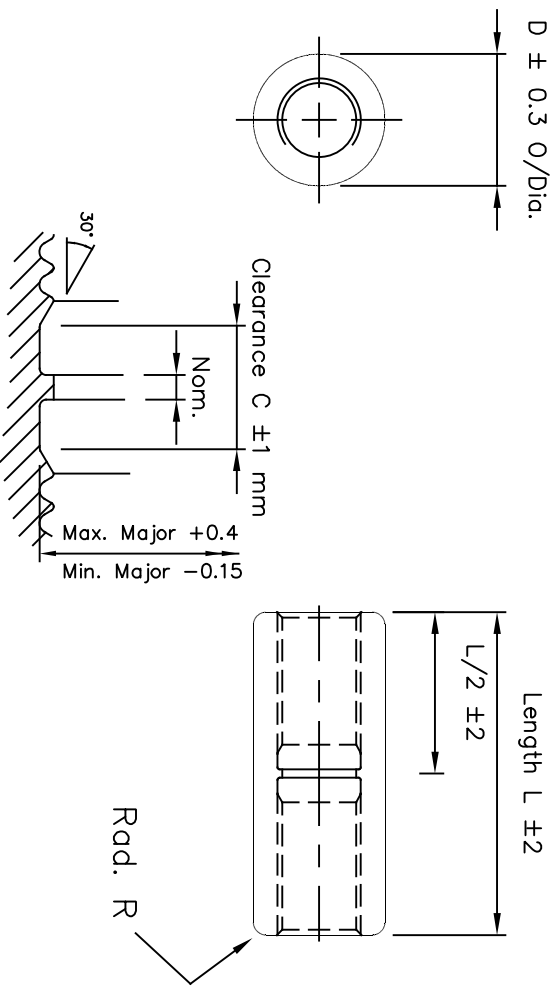
© It must not be copied or loaned without the consent of Macalloy Special Products and must be returned.

The diagram illustrates a grout vent assembly with the following components and dimensions:

- GROUT VENT**: The top section of the assembly.
- 'DEAD END' THREAD LENGTH**: The length of the threaded bar at the top end.
- JACKING THREAD LENGTH**: The length of the threaded bar in the middle section.
- WASHER**: A flat circular component at the top and bottom.
- NUT**: A hexagonal nut at the top and bottom.
- BEARING PLATE (WITH OR WITHOUT SPIGOT)**: A rectangular plate at the top and bottom.
- DUCT**: The central section of the assembly.
- BAR**: The central threaded rod.
- BEARING PLATE (WITH OR WITHOUT SPIGOT)**: A rectangular plate at the bottom.
- THREADED GROUT ENTRY**: The bottom section of the assembly.

ETA 07/0046 of 29.11.18 Page 27 of 38

ANNEX B – COUPLER DRAWINGS



DETAIL AT CENTRE

NOM. BAR DIA.	COUPLER REF.	OUTSIDE DIA. D	LENGTH L	CLEARANCE LENGTH C	END RADIUS R
mm		mm	mm	mm	mm
25	FC25	42.5	85	15(6+3+6)	3
26.5	FC26.5	42.5	90	15(6+3+6)	3
32	FC32	50	115	15(6+3+6)	4
36	FC36	57.5	130	15(6+3+6)	4
40	FC40	62.5	140	20(8+4+8)	5
50	FC50	76	170	20(8+4+8)	6
63*	FC63	98	208	20(8+4+8)	6
75*	FC75	110	230	20(8+4+8)	6

* NOT COVERED BY ETA APPROVAL

MATERIAL : GRADE 817M40 CONDITION V

TO BS EN 10083-1: 2006

(TO BS 970: Part 3, 1991)

HARDNESS ROCKWELL C,30 TO 38

[MIN. YIELD STRESS = 800 N/mm²] *
[MIN. U.T.S. = 1000 N/mm²]

THREAD : AS DRG. No. M/TP/25-75

CONCENTRICITY OF AXIS OF THREADS WITH OUTSIDE OF COUPLER TO BE WITHIN 0.25mm
RELIEVE THE THREADS AT THE FACE OF THE COUPLER BY 2mm AT 45°

CONDITION : COUPLERS SHALL BE SUPPLIED FREE FROM CRACKS OR OTHER DEFECTS WHICH COULD AFFECT THE SERVICE PERFORMANCE

IDENTIFICATION : ALL COUPLERS SHALL BE STAMPED WITH THE DIR/G ORDER No. AND BATCH No.

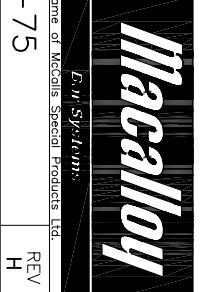
CERTIFICATION : A CERTIFICATE SHALL BE PROVIDED WITH EACH BATCH OF COUPLERS LISTING THE RELEVANT BATCH REFERENCES, THE STEEL ANALYSES AND THE MECHANICAL PROPERTIES OF EACH CAST OF STEEL REPRESENTED.

FOR REFERENCE ONLY *

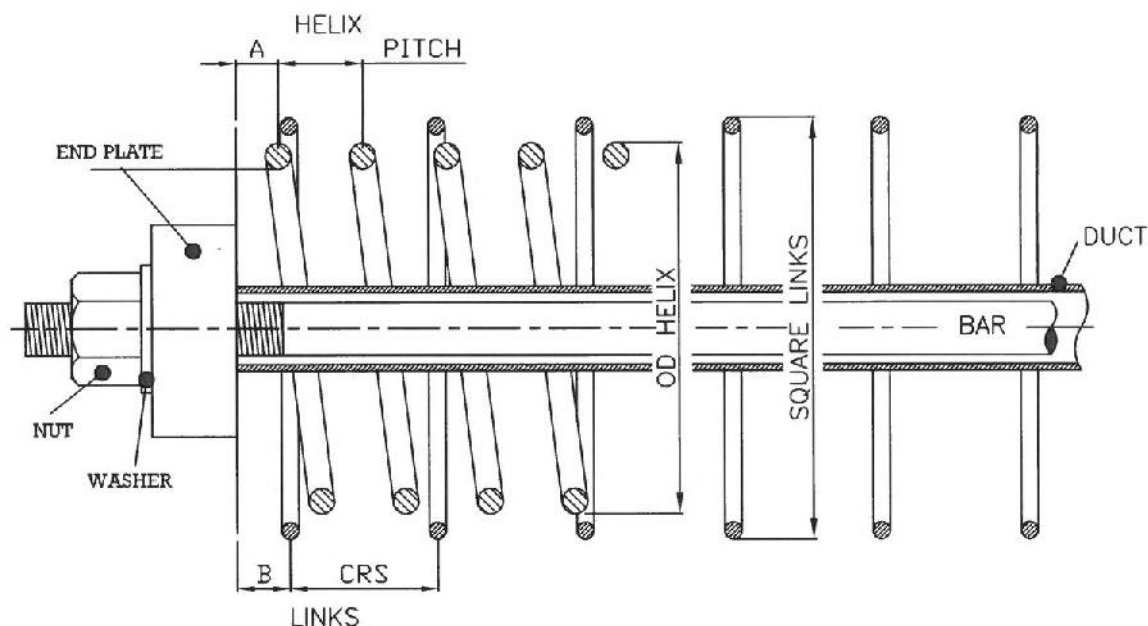
REV	INIT.	DATE	DESCRIPTION
CJ		24/11/16	FC63 RANGE ADDED & BS EN 10083 ISSUE YEAR UPDATED
H			
G	AS	15/05/14	ROCKWELL HARDNESS AMENDED TO SUIT MATERIAL STANDARD
F	RG	16/01/08	MATERIAL STANDARD ADDED.
E	PM	20/04/00	YIELD & UTS ADDED
D	PM	09/12/99	MATERIAL SPEC CHANGED
C	PM	04/04/97	LOGO CHANGE AND BRINELL HARDNESS REF REMOVED
B	PM	09/10/95	0.3 TOLERANCE WAS 0.125

TITLE			MACALLOY LTD		
DESIGNED			25 DIA. - 75 DIA.		
DRAWN			CHRIS PADDEY		
CHECKED			C JAYEOBA		
SCALE			FILE No.		
DATE			MAY, 92		
DATE			MAY, 92		
DATE			SEPT, 16		
DRG. No.			M/C/25-75		

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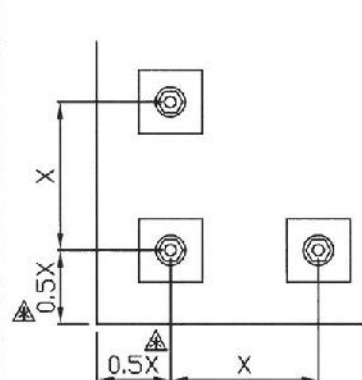


ANNEX C – BURSTING REINFORCEMENT



NOMINAL BAR DIAMETER	CONCRETE PRISM X-SECTION	HELIX					LINKS					RECOMMENDED DUCT INSIDE DIAMETER
		BAR ϕ	A	PITCH	OD	TURNS	BAR ϕ	B	CRS	SQU.	No.	
25	220x220	12	20	40	175	4	8	25	70	199	6	38
26.5	230x230	12	20	40	180	4	8	25	70	205	6	40
32	240x240	12	20	40	190	5	8	30	70	216	7	48
36	260x260	12	20	40	210	6	8	30	70	235	7	54
40	290x290	12	20	40	240	7	10	35	75	265	8	60
50	355x355	12	20	40	300	8	12	40	80	330	9	75

MINIMUM ANCHORAGE SPACING AND EDGE DISTANCE



NOMINAL BAR DIAMETER	X
25	220
26.5	230
32	240
36	260
40	290
50	355

▲ PLUS ANY ADDITIONAL REQUIRED COVER BEYOND 10mm

NOTES:

ALL DIMENSIONS IN mm.

ALL REINFORCEMENT TO EN 10080: 2005
MIN. CHARACTERISTIC PROPERTIES AS FOLLOWS:
YIELD STRENGTH 460 N/mm²
TENSILE/ YIELD RATIO 1.08
ELONGATION AT FRACTURE A5 14%
ELONGATION AT MAX. FORCE Agt 5%.

HELIX – SHAPE CODE 77 TO
EN ISO 3766: 2003

LINKS – SHAPE CODE 51 TO
EN ISO 3766: 2003, WHERE LENGTH A=B.

CONCRETE TO BE IN ACCORDANCE WITH
EN 206-1: 2000.
MINIMUM MEAN COMPRESSIVE STRENGTH AT FULL
PRESTRESS $F_{cm,o,cube}$ 35 N/mm²

THE ABOVE REINFORCEMENT AND EDGE DISTANCES MAY BE MODIFIED IN ACCORDANCE WITH NATIONAL REGULATIONS AND RELEVANT APPROVAL OF THE LOCAL AUTHORITY TO PROVIDE EQUIVALENT PERFORMANCE

B A RJG MAR 07 BS REFS REMOVED, CONCRETE CUBE STRENGTH ADDED.
REV INIT. DATE DESCRIPTION
RJG MAY 06 NOTES CHANGED TO INCLUDE EUROPEAN STANDARDS.

TITLE			
END BLOCK REINFORCEMENT			
DESIGNED	MACALLOY	DATE	JUNE 2006
DRAWN	MACALLOY	DATE	JUNE 2006
CHECKED	C. JAYEGBA	DATE	AUG 2017
SCALE	N.T.S.	FILE No.	

Macalloy Limited
Howke Street
Sheffield S9 2LN

TEL: 0114 2426704
FAX: 0114 2431324

Macalloy

Bar Systems

DRG. No. ETAG END BLOCK

REV B

ANNEX D: RECOMMENDATIONS FOR HANDLING, USE, INSTALLATION AND STORAGE OF PT KIT

D 1. HANDLING OF PT KIT

D 1.1 Bar Handling

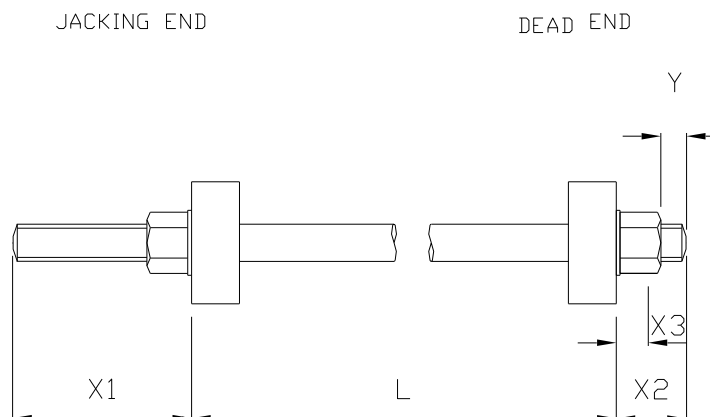
Macalloy 1030 Post Tensioning Bars should be stored on suitable battens, raising them above the ground. The battens should be at a minimum of 3m centres along the bar length. The bars should be protected using temporary covers. During handling, care should be taken to avoid local damage or bending. While light rusting is not harmful to the bars, deep corrosion pitting must be avoided. Macalloy 1030 bars should not be welded, subject to local heating or splashed with weld metal. All of which can change the metallurgical properties of the steel.

Bar threads must be clean before being engaged into a female thread. Bar threads can be lightly oiled to assist assembly. Superficial damage to the threads may be repairable by experienced personnel. However, re-cutting the thread form on site is impossible. The thread form is a proprietary one designed to be robust on site.

D 1.2 Tendon Handling

All female threads should be clean before assembly. Lightly oiling internal threads may aid assembly. Bars should be engaged to the mid-point of all couplers.

Bars should protrude by at least two thread form pitches beyond the nut or threaded plate – see below



X1 = Live End

X2 = Dead End

X3 = Tapped Plate

Y = Length of Bar Past Nut or Through Tapped Plate

12 for 6mm Pitch (25-36mm)

16 for 8mm Pitch (40-50mm)

D 2. MAINTENANCE AND REPAIR

D 2.1 Maintenance

The Macalloy 1030 Post Tensioning bar system requires no maintenance provided that it is protected from mechanical damage and corrosion. Protection may also be required against fire damage.

Occasionally, there may be a requirement to reassess the tensile load in a tendon, some time after installation and stressing. Provided that access can be gained to one end, where a nut and bearing plate exist and that the thread beyond the nut is of sufficient length and not corroded, a jack can be reattached and the load in the tendon assessed.

D 2.2 Repair

If any part of the Macalloy 1030 system suffers from mechanical damage or corrosion, or is subject to extreme heat as a result of a fire, then the manufacturer must be contacted to assess the damage. Light surface corrosion is generally permitted provided no pitting corrosion is present.

D 3. Ducts

Steel ducts should be in accordance with EN 523: 2003 and EN 524: 1997.

Plastic ducts should be in accordance with the requirements of EAD160004. The duct should be large enough to allow both the insertion of the bar and to facilitate grouting. Normally a maximum tendon to duct area ratio of 0.4 to 0.45 should be used. This ratio is defined as the cross sectional area of steel bar, divided by the internal cross sectional area of the duct. This ratio can be increased (i.e. duct inside diameter decreased) provided that grouting trials show that the duct can be satisfactorily grouted.

DC 4. CALCULATION OF BAR AND THREAD LENGTHS

D 4.1 Bar Lengths

Calculation of the overall length of bar is by measurement along the tendon profile and adding the thickness of both end plates plus an allowance for attaching the prestressing jack at one or both ends of the bar. When jacking at one end only, allowance must be made for a nut or tapped plate to be fitted at the opposite end.

Table D1 provides details of the allowances necessary for attaching the prestressing jacks.

Tendon	25	26.5	32	36	40	50
Jacking one end only X1 + X2 mm (min)	131	144	162	177	201	256
Jacking both ends 2 x X1 mm (min)	164	182	210	230	260	332
Tapped Plate One end X1 + X3 mm (min)	94	103	117	127	146	181

Table D1 - Jacking Allowance

D 4.2 Thread Lengths

The thread length at a jacking end must allow for attaching the jack plus elongation of the bar under working load.

The standard jacking thread is 250mm long which caters for tendon lengths up to 18m jacked one end or 36m jacked both ends. Additional thread length is needed for longer tendons at the rate of 25mm extra thread for each 5m of bar when jacked at one end or 10m of bar if jacked at both ends.

Standard thread lengths for jacking ends, dead ends and coupled joints are listed in Table D2.

Bar diameter mm	25	26.5	32	36	40	50
Jacking End mm	250	250	250	250	250	250
Dead End mm	100	100	100	100	100	100
Coupled Joint mm	45	50	60	65	75	85

Table D2 – Standard Thread Lengths

Alternatively, the manufacturing details may be stated as follows:

“x” No. of Macalloy bars “d” diameter x “l” overall length with end threads of length “S1” and “S2”.

D5. INSTALLATION AND STRESSING

D 5.1 Operators

Macalloy Ltd can provide a site stressing service. However, it is not uncommon for a contractor to carry out their own site operations or to employ a specialist third party contractor (post tensioning specialist). A post tensioning specialist will usually fix, stress and grout, or call upon Macalloy to carry out the stressing operation. Macalloy Ltd.'s approved stressing equipment should always be used. It is recommended that the specialist post tensioning contractor has a quality system that complies with the requirements of ISO 9001.

D 5.2 Equipment

A jack operating manual is available on request. This manual details the safe operation of all stressing equipment supplied by Macalloy Ltd.

The load measuring system employed, shall have an appropriate calibration certificate, not older than 6 months.

Macalloy jacks are calibrated against calibrated and certified load cells prior to being despatched from Macalloy premises. The load cells are calibrated against a UKAS approved tensile machine accurate to class 1 or 0.5 (depending on the load range). The load cells are checked at every 100 kN load intervals and any error recorded. If the error is greater than 1% the load cell is recalibrated. Across the whole calibrated range the uncertainty of jack load measurement is less than 2%.

If the measuring system employed is a manometer and a separate calibration is used, a minimum of two manometers should be available on site, with a calibration certificate that is not older than 6 months. They should be verified with a standard manometer every 100 stressing cycles.

D 5.3 Safety

It must be ensured that stressing equipment operators are competent in stressing as well as the use of any on site equipment. Although stressing should be a simple and safe operation, any carelessness or inappropriate use of equipment can have serious consequences. If necessary, adequate scaffolding or suspended movable platforms must be provided, together with lifting facilities such as a gantry. The scaffolding must be erected in accordance with applicable regulations and must be provided with a guard rail, access etc. The area for the work should be cleared and the platform erected at the correct height and sufficiently wide to enable the stressing work to be carried out.

Strong barricades should be erected at each end of the tendon in line with exposed ends during stressing. The barricades should be strong enough to absorb a significant proportion of the tendon energy if it should be accidentally released. The space between the tendon anchorage and the barricade should be roped off to prevent unauthorised passage. Notices stating 'DANGER – Tensioning in Progress' or similar, should be positioned in the immediate vicinity.

The hydraulic or hand pump equipment should be placed to one side and never in line with the bar being stressed.

Workmen and stressing operators must stay clear of each end of the bar during stressing. They must always stand to one side and never in line with the bar being stressed.

The operator should never use his fingers for tightening the nut or adjusting any fittings when the jack is under load.

D 5.4 Checks to be made before Stressing

Before stressing is carried out, it must be verified that the tendon and the conditions of tensioning are as per the specification and design details. In particular:

- (1) The concrete, jointing material and bearing material, as applicable, have gained the required strength. It is recommended that the appropriate test certificates are attached to the stressing records.
- (2) The test certificates for the bars to be stressed are available.
- (3) The space for the jack must be sufficient.
- (4) The element or structure should possess the required strength of degree of freedom under the pre-stressing force.

- (5) The tendons shall be free to move in the ducts and the bars must be in the correct location in relation to the anchorage zone reinforcement.
- (6) The surface to support the jack must have the correct shape and inclination.
- (7) The anchorages must be in their correct position and alignment. Misalignment of anchor plates up to 2 degrees can be accommodated without any loss of anchorage strength. Any misalignment in excess of this must be rectified by the use of suitable tapered plates or by re-bedding the plates.
- (8) A valid and signed jack calibration certificate must be supplied before the jack is used. The certificate must relate the actual force the jack exerts to the indicated hydraulic pressure or force. This calibration requirement is to ensure that the friction developed within the jack is taken account of. New calibration tests should be undertaken if either jack or gauge is replaced, or after 100 stressing operations, or after one weeks use, whichever is sooner.
- (9) The jack should at all times be supported independently and never permitted to hang on the bar, which could cause damage to the threads and induce bending into the bar.
- (10) The hydraulic hose should connect the jack and pump in an easy curve and should never be trapped against a sharp edge. Damaged hydraulic hoses must not be used for stressing.

D 5.5 The Stressing Operation

Prior to stressing, all calibrated pressure or force gauges should be treated with care as rough handling during transit or on site can upset the calibration.

Tendons must be stressed in the sequence indicated by the approved stressing schedules, which also indicated the stressing force. If the elongation of the tendon or the relevant force does not agree with the stressing instruction, the engineer responsible shall be consulted.

It is recommended that during stressing gauge readings are checked against the bars measured extension. The zero extension reading should be taken when the jack is just starting to take load and all the slack in the bar is taken up. A correlation between force and extension can be made by making use of the Modulus of Elasticity value given on the bar test certificate. Note that when stressing short tendons, the errors in measuring extension are larger than those measured for long tendons.

The stressing operation should be carried out under a steady and smooth increase in pressure and elongation of the pre-stressing steel. Constant watch must be maintained and should any irregularity occur (sharp noise etc.), the operation must be stopped and the cause investigated.

The stressing operation should not be carried out at temperatures below 0 degrees C, without the approval of the engineer.

Documentation recording the stressing operation, as indicated in Section 8, must be maintained.

During stressing the nut should be tightened against the washer as the bar extends.

During the stressing operation, it may be necessary to partially or completely de-tension the tendon.

This should be carried out in a controlled and progressive manor, while the jack is in place. The full load in the bar should be taken by the jack, while the nut is wound back from the bearing plate, the load should then be progressively released until the bar is completely de-stressed. If the jack ram extension runs out prior to the complete de-stressing, the nut should be wound tightly against the bearing plate, prior to the operation being repeated.

D 6. FINAL OPERATIONS

D 6.1 Grouting

Unless other forms of corrosion protection are used, grout should be pumped under pressure between the duct and bar. The grout and grouting procedures should be in accordance with EN 446 and EN 447. Special grout requirements are covered by ETAG013.

For 25mm and 26.5mm bar diameters, reference should be made to drawing 'Grout 25 & 26.5'. Grout should be injected between the bar and duct via a duct or grout saddle, with a grout inlet. Air is then vented via an air vent or similar duct or grout saddle with grout vent. The grout inlet should generally be positioned at the lower end of the tendon and the air vent at the higher end. If the tendon is horizontal, it is acceptable to grout as shown. For horizontal tendons with couplers, a grout vent may

be required at the highest point of the duct over the coupler, in order to fully encapsulate the bar and prevent air pockets.

For 32mm to 50mm bar diameters, inclusive, reference should be made to drawing 'GROUT 32-50'. Grout should be injected between the bar and duct via bearing plates with inclined grout holes. The grout inlet should be at the lowest end of the tendon with the grout being injected into the bottom of the duct. The air vent hole should be at the highest end of the tendon, venting from the top of the duct

D 6.2 Cutting off Excess Bar Thread

Excess bar thread may be cut off after stressing by sawing or disc cutting.

When disc cutting, a liberal supply of water is needed over the bar during the operation to limit the heat developed and surrounding bars should be protected from sparks or spatter. The cut must take no longer than 20 seconds and be at least 25mm from the nut.

D 6.3 Protection to Anchorage

Consideration to the corrosion protection of all exposed or outside surfaces should be made e.g. the bearing plate, nut, washer and bar end.

If required, the bearing plate and washer may be hot dip galvanized to EN ISO 1461: 2009. The nut and bar should not be hot dip galvanized. The bearing plate, nut, washer and bar end can, if necessary, be painted with a suitable paint system. An anchor head cap can, if necessary be fitted over the bar end, nut and washer and bolted to the bearing plate, with a gasket between the two. It is common to fill anchor head caps with a corrosion inhibiting grease or similar.

D 6.4 Documentation

A quality assurance plan should be implemented prior to the start of work on site.

It is useful to set out a project data sheet as a means of producing a permanent record of the work carried out, the desired load and extension values for each Macalloy bar and the measurements taken during jacking. The Data Sheet & Stressing Record following should be used for such recordings.

Proposed Project Data Sheet & Stressing Record

Project:

.....

Section or Bay Reference:

Date of Stressing

Concrete:

Date Cast

Cube Crushing Strength :

..... N/mm² at days.

..... N/mm² at days.

..... N/mm² at days.

Prestressing / Post Tensioning Steel:

Macalloy 1030 nominal bar diameter

Characteristic ultimate tensile stress: 1030 N/mm²

Minimum 0.1% proof stress: 835 N/mm²

Nominal cross sectional area:mm²

Characteristic failure load:kN

Minimum 0.1% proof load:kN

Modulus of elasticity:kN/mm² (taken from test certificate)

Relaxation at 70% UTS after 1000 hrs: 3% typicall.

Tendon:

Type: bonded un-bonded internal external (circle one)

Corrosion protection: grout plastic duct & grout Denso tape Denso tape & duct

Other (specify)

Duct dimensions:

Unintentional deviation / wobble coefficient.....rad/m.

Duct support spacing.....

Anchorage:

Anchor bearing plate size – live (stressing end)

Anchor bearing plate size – dead end

Spacing:

Min edge distance:

Stressing Record								
		Calculated	Measure Values					
Bar Mark	Dia (mm)	Extension (mm)	Initial Ram Position	Load	Final Ram Position	Load	Total Extension	Remarks
1								
2								
3								
4								
5								