CARES Technical Approval Report TA1-C 5014

Issue 13

Dextra

GRIP TEC
PARALLEL THREAD COUPLERS

DEXTRA
GRIPTEC Extruded Coupler

Assessment of the Dextra GRIPTEC Extruded Coupler and Quality System for Production

CARES TECHNICAL APPROVAL 5014

UKAS PRODUCT CERTIFICATION 002

Product

Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging mechanical couplers for reinforcing steel.

Product approval held by:

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1 Product Summary

Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers as detailed in tables 1 to 11 are for the mechanical connection of deformed high yield carbon steel bars for the reinforcement of concrete complying with the requirements of BS4449 Grade B500C.

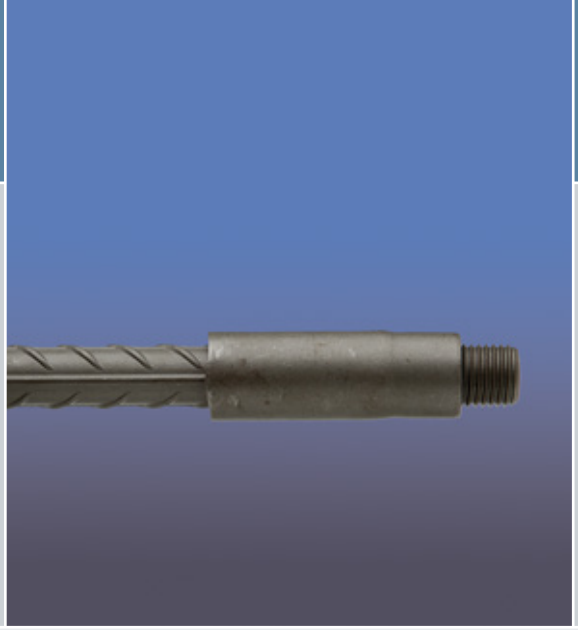
1.1 Scope of Application

Dextra GRIPTEC couplers have been evaluated for use as follows:

GRIPTEC standard, GRIPTEC positional, GRIPTEC transitional, GRIPTEC bridging, GRIPTEC bridging transitional and GRIPTEC caging couplers requirements in accordance with CARES TA1-C as detailed in tables 1 to 11.

1.2 Design Considerations

BS 8110 Clause 3.12.8.9 Laps and Joints states "Connections transferring stress may be lapped, welded or joined with mechanical devices. They should be placed, if possible, away from points of high stress and should preferably be staggered". However, BS 8110 Clause 3.12.8.16.2 Bars in tension states "The only acceptable form of full-strength butt joint for a bar in tension comprises a mechanical coupler" satisfying specified slip and tensile strength criteria.



Eurocode 2, Clause 8.7 Laps and mechanical couplers 8.7.1 General (1)P "Forces are transmitted from one bar to another by:

- lapping of bars, with or without bends or hooks;
- welding;
- mechanical devices assuring load transfer in tension-compression or in compression only."

Clause 8.8 Additional rules for large diameter bars goes on to state that "Splitting forces are higher and dowel action is greater with the use of large diameter bars. Such bars should be anchored with mechanical devices."

The specified cover for fire resistance and durability should be provided to the coupler sleeve. All couplers have been designed with controlled mechanical properties to be compatible with reinforcing bars complying with reinforcement of the relevant Grade in accordance with BS4449.

1.3 Conclusion

It is the opinion of UK CARES that Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers are satisfactory for use within the limits stated in paragraph 1.1 when applied and used in accordance with the manufacturer's instructions and the requirements of this certificate.

L. Brankley
Chief Executive Officer
October 2019

2 Technical Specification

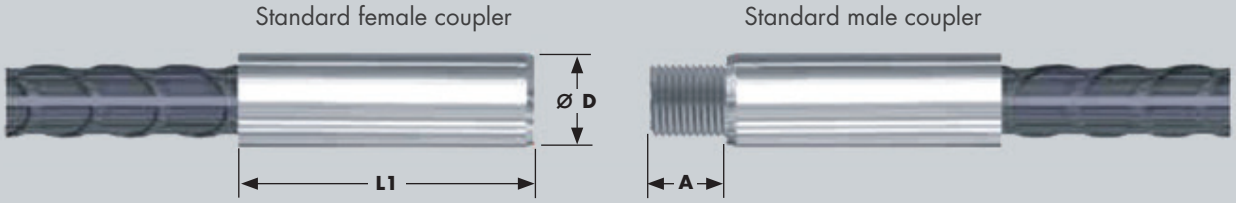
2.1 General

Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers are for joining deformed grade B500C reinforcing bars. The couplers comprise two ends, extruded onto the reinforcing steel and joined by a parallel thread connection. The Dextra GRIPTEC extrusion machine automatically conducts systematic performance testing of every joint.

2.2 GRIPTEC Standard Range

The GRIPTEC standard coupler is designed for use where one of the bars to be spliced can be rotated. It comprises two steel sleeves that are swaged onto the bar ends and have matching male and female parallel ISO threads which allow the two bars to be joined.

Standard Coupler



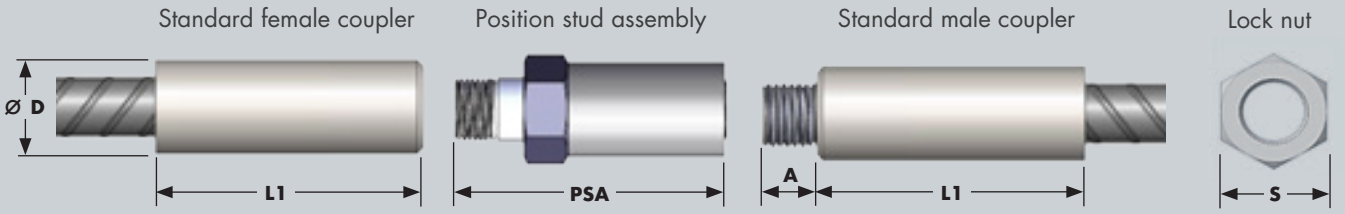
Size (mm)	Art No	D (mm)	L1 (mm)	A (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
12	AG12	19 to 20	66 to 72	12	0.2	Yellow	A	Tension-Compression
14	AG14	21 to 22	85 to 88	14	0.4	Blue	A	Tension-Compression
16	AG16	25 to 26	99 to 103	16	0.5	White	A	Tension-Compression
20	AG20	32.5 to 35	114 to 132	20	1.1	Grey	A	Tension-Compression
20	AG20N	29.5 to 32	107 to 110	20	1.1	Grey	A	Tension-Compression
25	AG25	37 to 39	112 to 125	22	1.2	Red	A	Tension-Compression
32	AG32	46 to 48	137 to 150	28	2.1	Brown	A	Tension-Compression
32	AG32N	47 to 49	137 to 143	28	2.1	Brown	A	Tension-Compression
40	AG40	63 to 65	165 to 178	34	5.6	Green	A	Tension-Compression
40	AG40N	61 to 63	167 to 170	34	5.6	Green	A	Tension-Compression
50	AG50N	71 to 73	220 to 225	47	8.6	Grey	A	Tension Only

Table 1

2.3 GRIPTEC Positional Range

The GRIPTEC positional "AGPC" coupler range is designed for use where neither of the bars to be coupled can be rotated. The positional coupler comprises five components: the same male and female sleeves as in the Standard coupler, plus a position stud (that screws itself into the female sleeve), a position nut (that screws itself onto the male sleeve), and a lock nut.

Positional Coupler



Size (mm)	Art No	D (mm)	PSA (mm) (Approx)	S (mm)	L1 (mm)	A (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
12	AGPC12	19 to 20	60	22	66 to 72	12	0.3	Yellow	A	Tension Only
16	AGPC16	25 to 26	77	27	99 to 103	16	0.7	White	A	Tension Only
20	AGPC20	32.5 to 35	94	32	114 to 132	20	1.5	Grey	A	Tension Only
25	AGPC25	37 to 39	107	41	112 to 125	22	2.0	Red	A	Tension Only
32	AGPC32	46 to 48	133	50	137 to 150	28	4.0	Brown	A	Tension Only
40	AGPC40	63 to 65	161	65	165 to 178	34	8.8	Green	A	Tension Only

Table 2

The GRIPTEC positional "AGP" coupler range has the same components as "AGPC" coupler range, but the design of a position stud has larger bear area of shoulder.

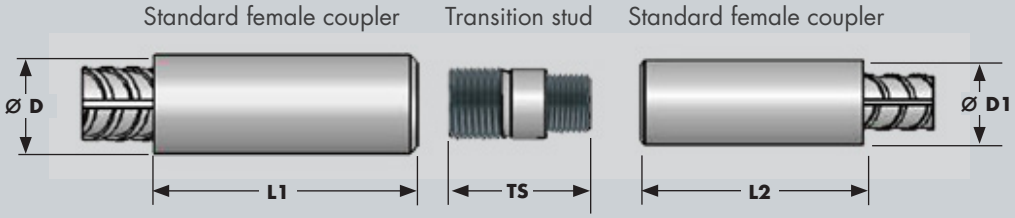
Size (mm)	Art No	D (mm)	PSA (mm) (Approx)	S (mm)	L1 (mm)	A (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
12	AGP12	19 to 20	60	22	66 to 72	12	0.3	Yellow	A	Tension Only
14	AGP14	21 to 22	69	24	85 to 88	14	0.5	Blue	A	Tension Only
16	AGP16	25 to 26	77	27	99 to 103	16	0.7	White	A	Tension Only
20	AGP20	29.5 to 32	94	32	107 to 110	20	1.5	Grey	A	Tension-Compression
25	AGP25	37 to 39	107	41	112 to 125	22	2.0	Red	A	Tension-Compression
32	AGP32	47 to 49	133	50	137 to 143	28	4.0	Brown	A	Tension-Compression
40	AGP40	61 to 63	161	65	167 to 170	34	8.8	Green	A	Tension-Compression

Table 3

2.4 GRIPTEC Transitional Range

The GRIPTEC transitional "AGT" coupler range is designed to splice reinforcing bars of different diameters. The transitional coupler comprises three components; two female GRIPTEC standard sleeves extruded onto the bar ends, connected by a steel stud.

Transitional Coupler



Size (mm)	Art No	D (mm)	D1 (mm)	L1 (mm)	L2 (mm)	TS (mm) (Approx)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
20/25	AGT25/20	37 to 39	32.5 to 35	112 to 125	114 to 132	64	1.0	Grey / Red	A	Tension only
25/32	AGT32/25	46 to 48	37 to 39	137 to 150	112 to 125	67	1.7	Red / Brown	A	Tension only
32/40	AGT40/32	63 to 65	46 to 48	165 to 178	137 to150	83	4.0	Brown / Green	A	Tension only

Table 4

The GRIPTEC transitional "AGTS" coupler range has the same components as "AGT" coupler range, but the design of a transitional stud has larger bear area of shoulder.

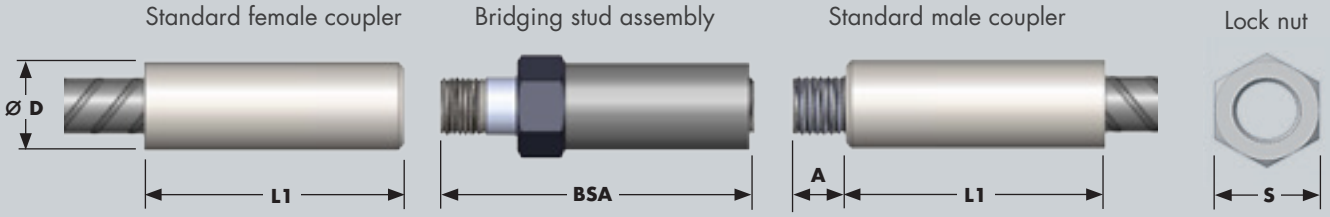
Size (mm)	Art No	D (mm)	D1 (mm)	L1 (mm)	L2 (mm)	TS (mm) (Approx)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
16/20	AGTS20/16	29.5 to 32	25 to 26	107 to 110	99 to 103	47	0.6	White / Grey	A	Tension-Compression
20/25	AGTS25/20	37 to 39	29.5 to 32	112 to 125	107 to 110	56	1.0	Grey / Red	A	Tension-Compression
25/32	AGTS32/25	47 to 49	37 to 39	137 to 143	112 to 125	67	1.7	Red / Brown	A	Tension-Compression
32/40	AGTS40/32	61 to 63	47 to 49	167 to 170	137 to143	83	4.0	Brown / Green	A	Tension-Compression
40/50	AGTS40/50	71 to 73	61 to 63	220 to 225	167 to170	107	8.7	Green / Grey	A	Tension-Compression

Table 5

2.5 GRIPTEC Bridging Range

The GRIPTEC bridging "AGPD" coupler range is designed for use where the bars cannot be brought butt to butt. It is similar to the positional coupler, the only difference being that the stud and the nut are longer, in order to cover a gap between the two bar ends.

Bridging Coupler



Size (mm)	Art No	D (mm)	BSA (mm)	S (mm)	L1 (mm)	A (mm) (Approx)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
16	AGPD16	25 to 26	114	27	99 to 103	16	0.8	White	A	Tension Only
20	AGPD20	32.5 to 35	130	32	114 to 132	20	1.5	Grey	A	Tension Only
25	AGPD25	37 to 39	151	41	112 to 125	22	1.9	Red	A	Tension Only
32	AGPD32	46 to 48	176	50	137 to 150	28	3.4	Brown	A	Tension Only
40	AGPD40	63 to 65	206	65	165 to 178	34	8.3	Green	A	Tension Only

Table 6

The GRIPTEC bridging "AGB" coupler range has the same components as "AGPD" coupler range, but the design of a bridging stud has larger bear area of shoulder.

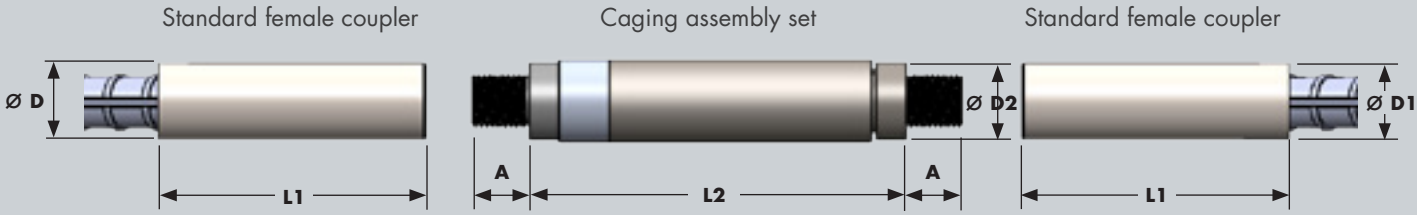
Size (mm)	Art No	D (mm)	BSA (mm)	S (mm)	L1 (mm)	A (mm) (Approx)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
16	AGB16	25 to 26	114	27	90 to 103	16	0.9	White	A	Tension Only
20	AGB20	29.5 to 32	130	32	107 to 110	20	1.5	Grey	A	Tension-Compression
25	AGB25	37 to 39	151	41	112 to 125	22	1.9	Red	A	Tension-Compression
32	AGB32	47 to 49	176	50	137 to 143	28	3.4	Brown	A	Tension-Compression
40	AGB40	61 to 63	206	65	167 to 170	34	8.3	Green	A	Tension-Compression
50	AGB50	71 to 73	258	80	220 to 225	47	17.8	Grey	A	Tension Only

Table 7

2.6 GRIPTEC Caging Range

The GRIPTEC caging "GCA" coupler range is designed for use when the two bars are not well aligned. This splice uses two standard GRIPTEC female couplers swaged onto the bar ends, that are connected by a GRIPTEC® "Caging assembly set", which is constituted of a taper stud, a long caging stud, a caging nut and a lock-nut which are pre-assembled together. The tapered caging stud is screwed into a female sleeve, while, the set of a long caging stud, a caging nut and a lock-nut is screwed onto another female sleeve. Then, in order to accomplish the connection, the caging nut is screwed out of the caging stud and onto the tapered caging stud. The two bars do not need to be brought butt-to-butt: the GRIPTEC® caging splice system can bridge a gap between the bars.

Caging Coupler



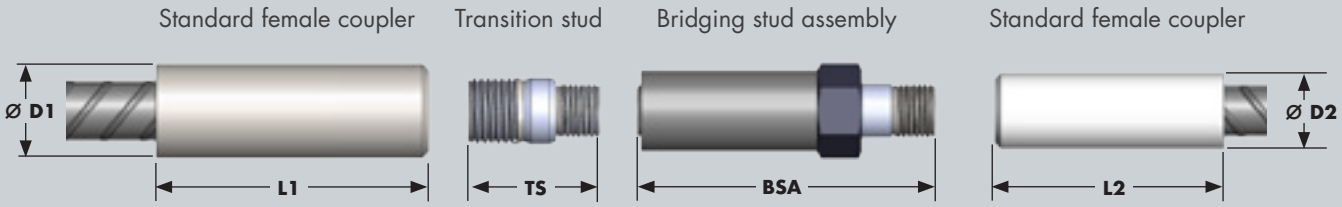
Size (mm)	Art No	D1 (mm)	D2 (mm)	L1 (mm)	A (mm)	L2 (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
32	GCA32	47 to 49	50	137 to 143	28.5	226	3.7	Brown	A	Tension-Compression
40	GCA40	63 to 65	65	167 to 170	35	269	7.4	Green	A	Tension-Compression

Table 8

2.7 GRIPTEC Bridging Transitional Range

The GRIPTEC bridging transition coupler range is designed to connect two bars of different diameters, neither of which can be brought butt to butt. The bridging transition coupler comprises six components: two standard female GRIPTEC sleeves swaged onto the bar ends, plus a Transition stud and a Bridging stud (that screw themselves into the female sleeves), a Bridging nut (that screws itself out of the bridging stud and onto the transition stud), and a lock nut.

Bridging Transitional Coupler



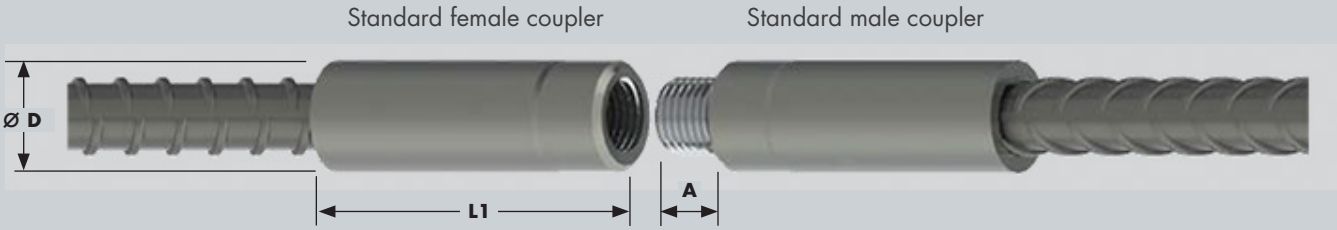
Size (mm)	Art No	D1 (mm)	D2 (mm)	TS (mm)	BSA (mm)	L1 (mm)	L2 (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ Compression
32/40	AGBT40/32	61 to 63	47 to 49	83	176	167 to 170	137 to 143	3.2	Brown / Green	A	Tension-Compression

Table 9

2.8 GRIPTEC Standard G range coupler

The GRIPTEC standard "G" coupler range is designed for use where one of the bars to be spliced can be rotated. It comprises two steel sleeves that are extruded onto the bar ends and have matching male and female parallel ISO threads which allow the two bars to be joined.

Standard G Coupler



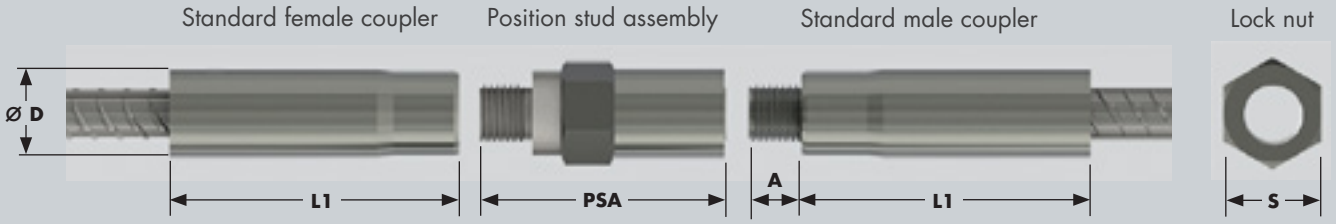
Size (mm)	Art No	D (mm)	L1 (mm)	A (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ compression
25	G25	37 to 39	118 to 131	28	1.4	Red	A	Tension-Compression
32	G32	47 to 49	141 to 147	35	2.7	Brown	A	Tension-Compression
40	G40	61 to 63	176 to 187	40	5.3	Green	A	Tension-Compression

Table 10

2.9 GRIPTEC GPA Positional range

The GRIPTEC "GPA" positional coupler range is designed for use where neither of the bars to be coupled can be rotated. The positional coupler comprises five components: the same male and female sleeves as in the standard coupler, plus a position stud (that screws itself into the female sleeve), a position nut (that screws itself onto the male sleeve), and a lock nut.

GPA Positional Coupler



Size (mm)	Art No	D (mm)	PSA (mm)	S (mm)	L1 (mm)	A (mm)	Weight (kg)	Plastic protection colour	Sellafield coupler class	Tension/ compression
25	GPA25	37 to 39	137	41	118 to 131	28	2.5	Red	A	Tension-Compression
32	GPA32	47 to 49	171	50	141 to 147	35	4.3	Brown	A	Tension-Compression
40	GPA40	61 to 63	203	65	176 to 187	40	9.3	Green	A	Tension-Compression

Table 11

3 Product Performance and Characteristics

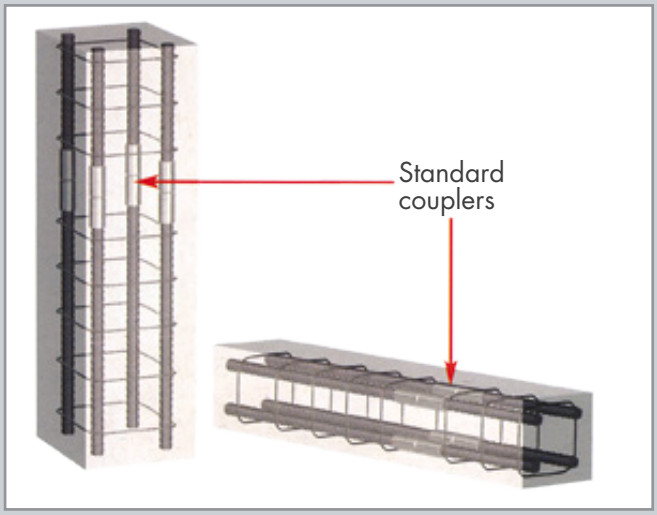
Full destructive tests have been carried out to demonstrate compliance with performance requirements defined in CARES Appendix TA1-B and TA1-C when used with reinforcing bars to BS4449 Grade B500C:

CARES APPENDIX TA1-B

- Permanent elongation is less than 0.10mm at $0.65f_y$ in tension-compression (see tables for details).
- Tensile strength is greater than 575 MPa.

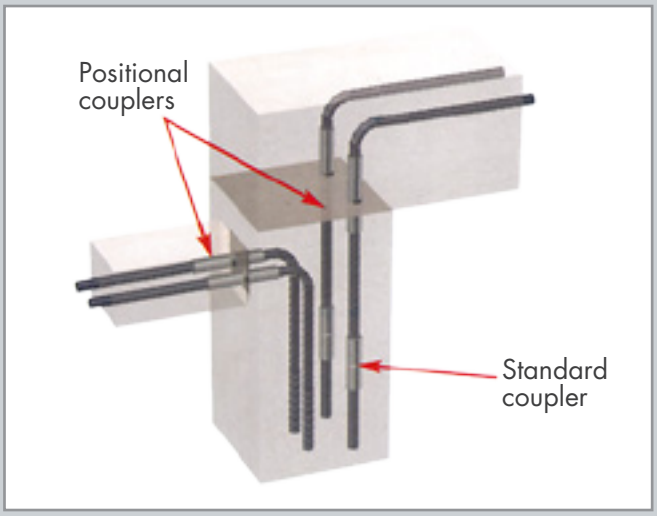
CARES APPENDIX TA1-C

- Permanent deformation is less than 0.10mm at $0.65f_y$ in tension-compression (see tables for details).
- Tensile strength is greater than $1.15 \times R_{e,\,act}$ and less than $1.35 \times R_{e,\,act}$ and greater than the load required to produce 2% strain in the reference bars.
- Cyclic loading of 100 cycles between 5% and 90% f_y.
- Reduced temperature performance at -7°C.
- Bar break mode of failure (for Type A couplers only).



Typical application of GRIPTEC standard coupler

The GRIPTEC standard couplers are for use in situations where one or both bars to be joined can be rotated freely



Typical application of GRIPTEC positional coupler

The GRIPTEC positional couplers are designed to use where neither bar is free to be turned. It is also desirable for long and heavy bars even though they are straight

4 Installation

The bars to be spliced must be sheared with suitable shears that do not bend or deform the bar or leave a significant rag.

Griptec sleeve before extrusion

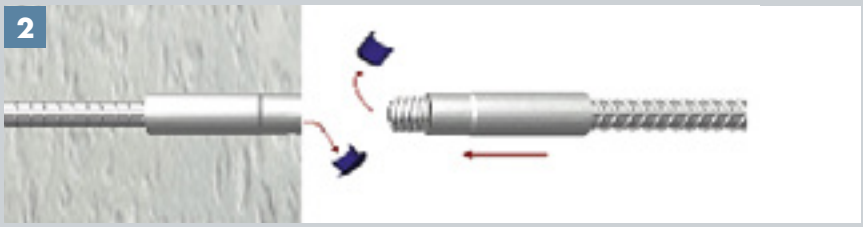
Griptec sleeve after extrusion

Sleeves must by extruded onto the bar ends exclusively using the Dextra GRIPTEC extrusion machine operated by suitably trained staff in accordance with the Dextra operating manual. The parts are screwed together and tightened using a suitable tool/wrench. A torque wrench is not necessary.

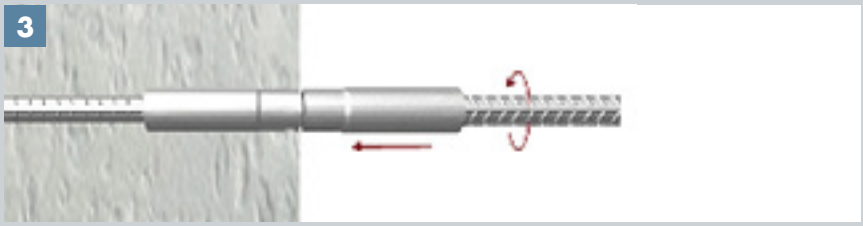
GRIPTEC extrusion machine

4.1 Standard Range

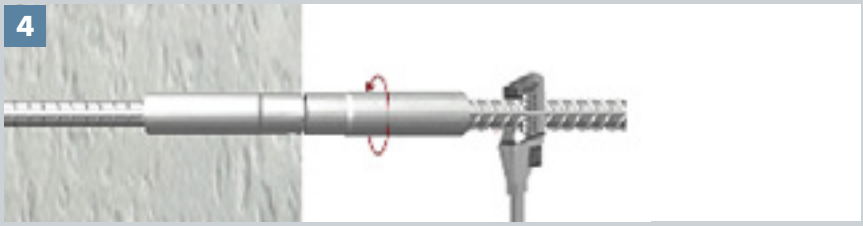
Position the 1st stage bar



Position the continuation bar
Remove caps



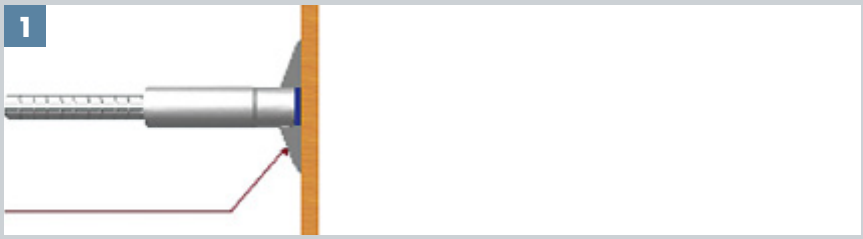
Screw in the continuation bar
A suitable tool/wrench maybe used to ensure no threaded portion is visible outside the coupler



Lock the splice
Use a suitable tool/wrench on the continuation bar and tighten until the internal end faces of the couplers show close physical contact with each other

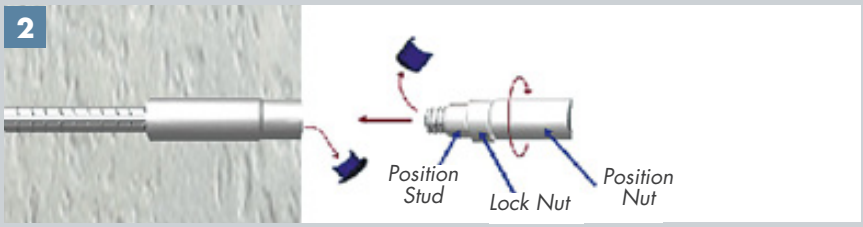
4.2 Positional Range

1



Position the 1st stage bar

2



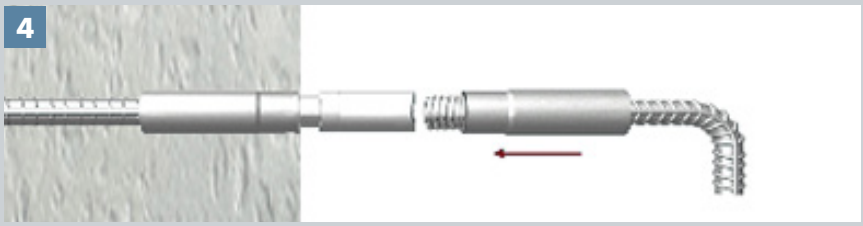
Remove caps and screw the position set into the female sleeve

3

Lock the position stud

Use a suitable tool/wrench to tighten the position stud

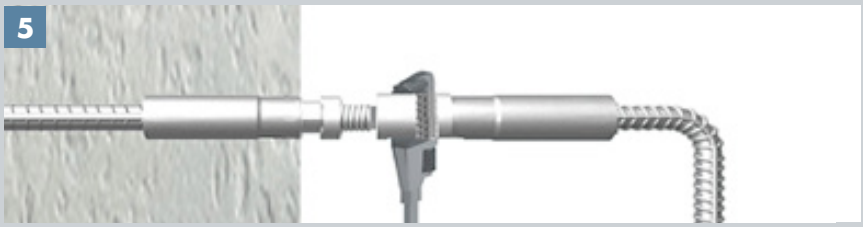
4



Position the continuation bar

Connect bar ends

5



Join the bars by rotating the position nut

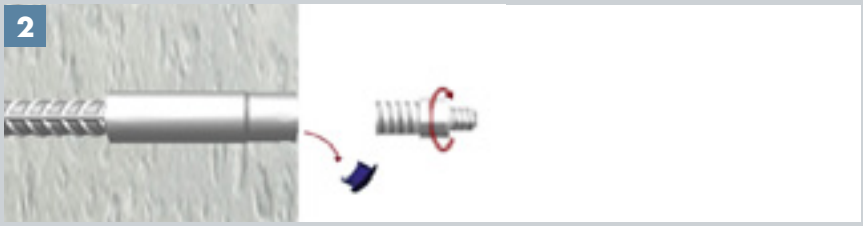
6

Lock the splice

Use a suitable tool/wrench on the continuation bar and tighten until the internal end faces of the couplers show close physical contact with each other

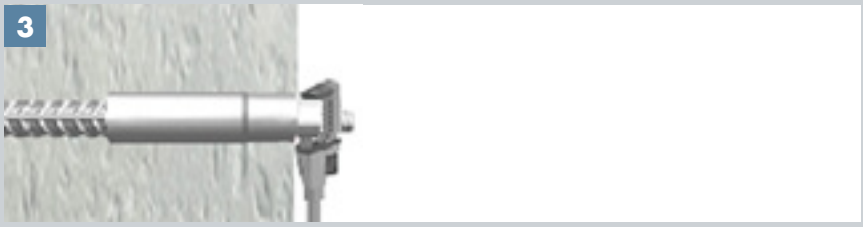
4.3 Transitional Range

Position the 1st stage bar

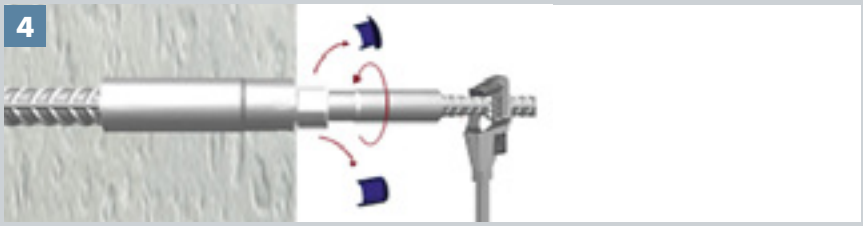


Screw the transition stud into the female coupler

Remove the cap from the bar and screw in the transition stud



Lock the transition stud

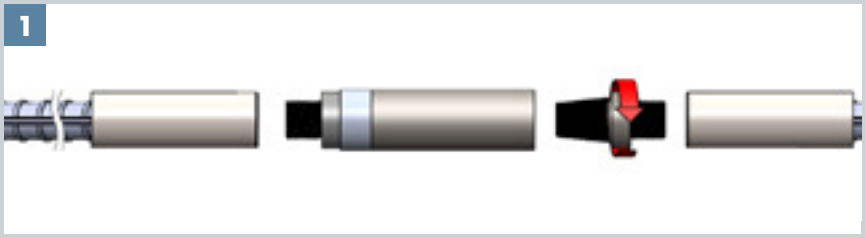


Screw the continuation bar

Remove the caps from the bar and the transition stud. Use a suitable tool/wrench on the continuation bar and tighten until the internal end faces of the couplers show close physical contact with each other

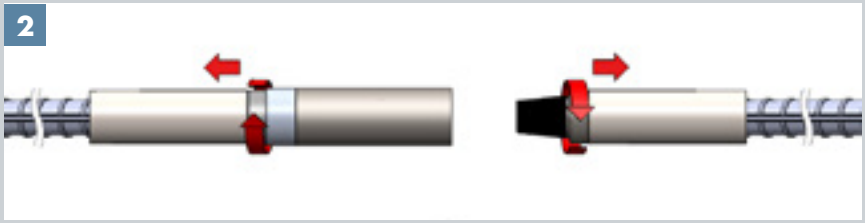
4.5 Caging Range

1



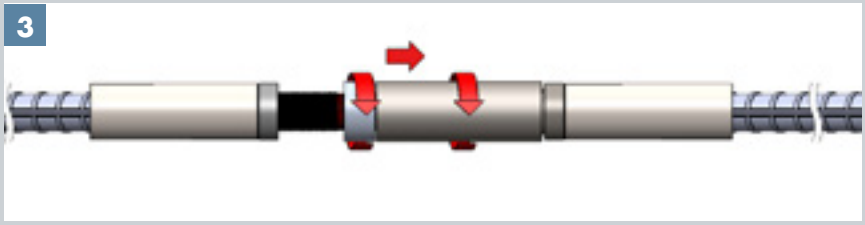
Remove the Tapered caging stud from the Griptec caging assembly set

2



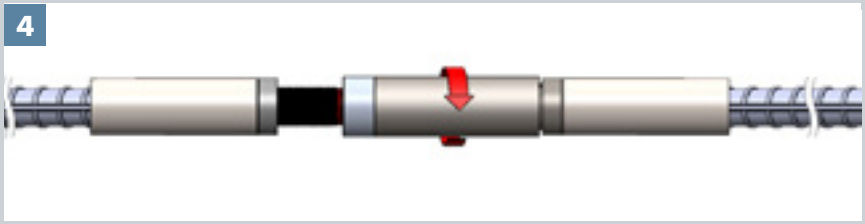
Screw the tapered caging stud into the female sleeve of one bar, and screw the Griptec caging assembly set into the female sleeve of the other bar

3



Assemble the splice by hand screwing the caging nut and lock nut onto the tapered caging stud

4

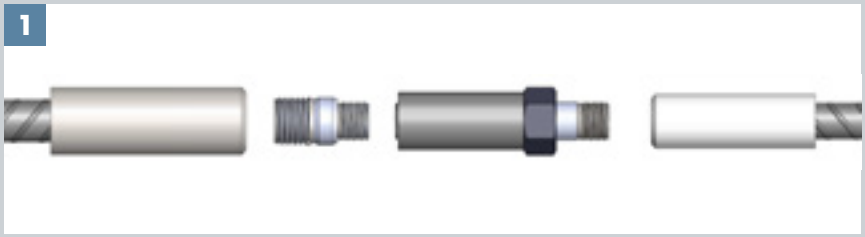


Use a torque wrench to tighten the caging nut onto the tapered caging stud. Adjust it to the torque value specified in the table below

Bar Size	Torque (Nm)
32	350
40	500

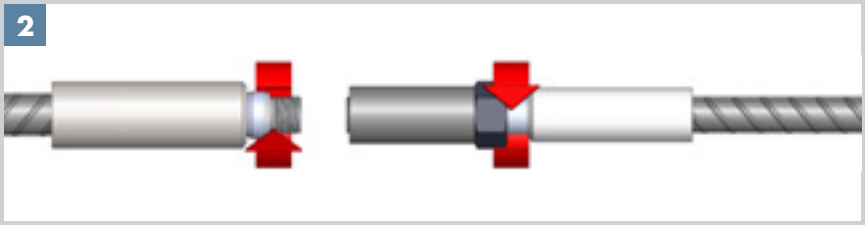
4.6 Bridging Transitional Range

1



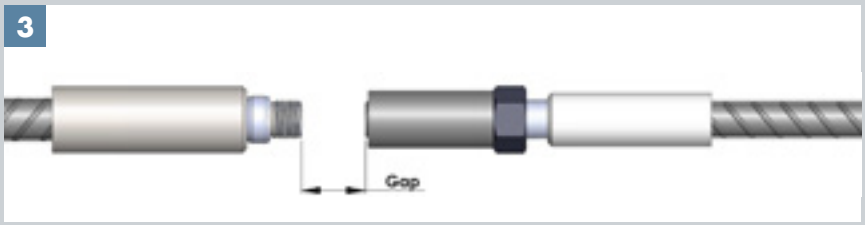
Prepare the Griptec Bridging Transitional assembly set

2



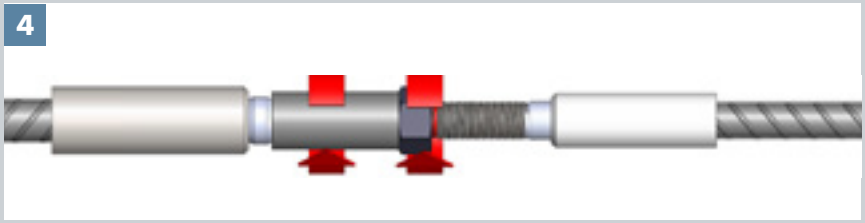
Screw the bridging assembly set into the female sleeve of the smaller bar, and screw the transition stud into the female sleeve of the larger bar

3



Bring the continuation bar as close as possible to the first stage bar

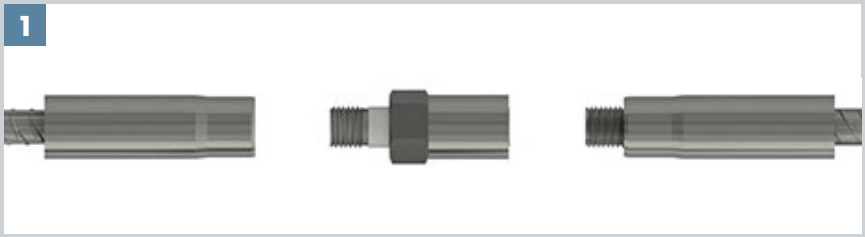
4



Screw the bridging nut and lock nut out of the bridging stud and onto the transition stud. Use a stilson or pipe wrench to tighten the bridging nut and lock nut

4.6 GPA Positional Range

1

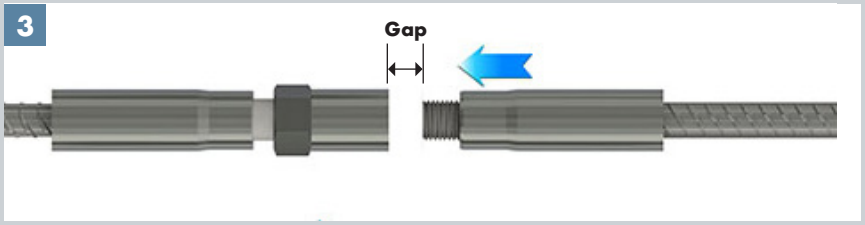


Prepare the Griptec GPA Positional assembly set

2

Screw the GPA positional set into the female sleeve

3

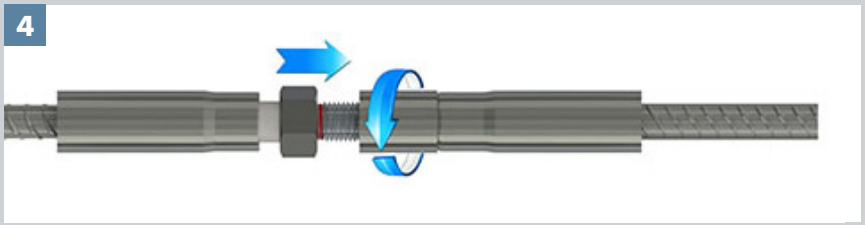


Position the continuation bar

Check that the gap between two bar ends does not exceed the value in the table below

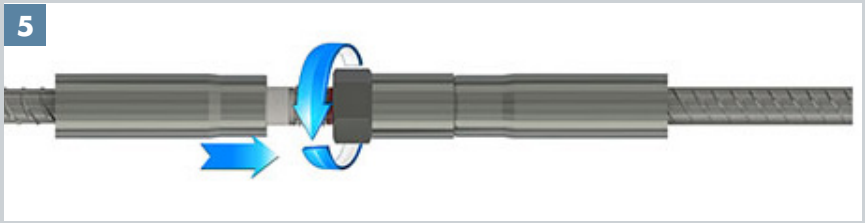
Bar Size	Max Gap (mm)
25	20
32	25
40	25

4



Join the bars by rotating the position nut onto the male sleeve

5



Hand screw the lock nuts until contact is made with the position nuts, and the lock the splice

Use a suitable tool/wrench on the continuation bar and tighten until the internal end faces of the couplers show close physical contact with each other

5 Safety Considerations

Couplers are supplied in wooden containers and have a maximum weight of 2500 kg and must be handled with appropriate lifting equipment. It is advisable to wear protective gloves during handling the containers, couplers and reinforcement; during the swaging process and during coupler installation.

6 Product Testing and Evaluation

Dextra GRIPTEC swaged couplers have been tested to satisfy the requirements of CARES Appendix TA1-B, TA1-C and the Sellafield Specification for Couplers with reinforcing bars to BS4449 Grade B500C. The testing comprised the following elements:

- Tensile Strength*
- Permanent Deformation*
- Cyclic Loading
- Strain
- Mode of failure

* Low temperature testing at -7°C was included

The products are subject to a programme of periodic testing to ensure that they remain within the performance limits of this technical approval.

7 Quality Assurance

Dextra swaged couplers are produced under an ISO9001 quality management system certified by CARES. The quality management system scheme monitors the production of the couplers and ensures that materials and geometry remain within the limits of this technical approval.

8 Building Regulations

8.1 The Building Regulations (England and Wales)

Structure, Approved Document A

Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers, when used in EC2 based designs using the data contained within this technical approval, satisfy the relevant requirements of The Building Regulations, Approved Document A.

Materials and Workmanship, Approved Document

This technical approval gives assurance that the Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers comply with the material requirements of EC2.

8.2 The Building Regulations (Northern Ireland)

Materials and Workmanship

This technical approval gives assurance that Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers comply with the material requirements of EC2 by virtue of regulation *23, Deemed to satisfy provisions regarding the fitness of materials and workmanship.*

8.3 The Building Standards (Scotland)

Fitness of Materials

This technical approval gives assurance that Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers comply with the material requirements of EC2 by virtue of *Clause 0.8.*

Structure

Dextra GRIPTEC standard, positional, transitional, bridging, bridging transitional and caging couplers, when used in EC2 based designs using the data contained within this technical approval, satisfy the requirements of *The Building Standards (Scotland) Clause 1.*

9 References

- BS 4449: 2005 Steel for the reinforcement of concrete - Weldable reinforcing steel - Bar, coil and decoiled product - Specification.
- BS8110: Part 1: 1997 (amended 2007): Structural Use of Concrete, Code of Practice for Design and Construction.
- BS EN 1992-1-1: 2004 Eurocode 2 Design of concrete structures - General rules for buildings.
- BS EN ISO 9001: Quality management systems - Requirements.
- CARES Appendix TA1-B: Quality and Operations Schedule for the Technical Approval of Couplers for Reinforcing Steel For BS8110 Applications for Static Tension or Static Compression.
- CARES Appendix TA1-C: Quality and Operations Schedule for the Technical Approval of Tension Couplers for Reinforcing Steel for Sellafield Standard Applications.
- Sellafield ES_0_3110_2-Issue 1 mechanical splices and anchors - manufacturing, installation and construction.

10 Conditions

1. The quality of the materials and method of manufacture have been examined by CARES and found to be satisfactory. This technical approval will remain valid providing that:

   a. The product design and specification are unchanged.
   b. The materials, method of manufacture and location are unchanged.
   c. The manufacturer complies with CARES regulations for technical approvals.
   d. The manufacturer holds a valid CARES Certificate of Product Assessment.
   e. The product is installed and used as described in this report.

2. CARES make no representation as to the presence or absence of patent rights subsisting in the product and/or the legal right of DEXTRA to market the product.

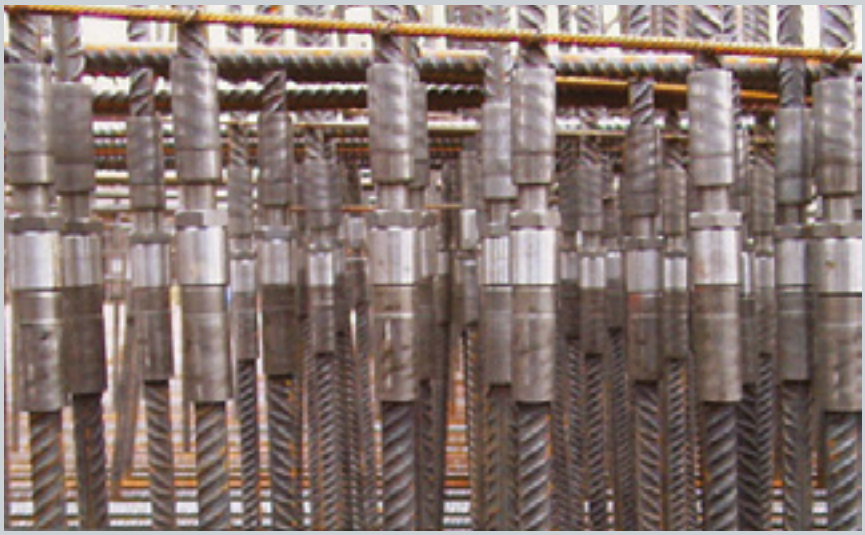
3. Any references to standards, codes or legislation are those which are in force at the date of this certificate.

4. Any recommendations relating to the safe use of this product re the minimum standards required when the product is used. These requirements do not purport to satisfy the requirements of the Health and Safety at Work act 1974 or any other relevant safety legislation.

5. CARES does not accept any responsibility for any loss or injury arising as a direct or indirect result of the use of this product.

6. This Technical Approval Report should be read in conjunction with CARES Certificate of Product Assessment No 5014. Confirmation that this technical approval is current can be obtained from UK CARES.

GRIPTEC Coupler Applications



The use of GRIPTEC couplers allows the design and installation of reinforcement in congested areas or where the continuation bars cannot be rotated.

GRIPTEC couplers allow reinforcing bars to be butt jointed.

Griptec bar end preparation takes about 30 seconds.

GRIPTEC standard coupler

GRIPTEC positional coupler

GRIPTEC transitional coupler

TECHNICAL APPROVAL 5014

UKAS PRODUCT CERTIFICATION 002

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Independent Product Assessments for the Construction Industry

3.10.19