

CARES Technical Approval Report TA1-B 5074



Issue 2



APTUS Adjustable Coupler

Assessment of the
APTUS Adjustable
Coupler Product
and Quality System
for Production



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Product

APTUS Adjustable Coupler for reinforcing steel

Product approval held by:

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1 Product Summary

APTUS Adjustable Coupler in the size range 20mm - 40mm are for the mechanical connection of deformed high yield carbon steel bars for the reinforcement of concrete complying with the requirements of BS4449 Grade B500B and B500C.

1.1 Scope of Application

APTUS Adjustable Couplers in the size range 20mm - 40mm using the threaded stud lengths as detailed in table 1 have been evaluated for use as follows:

For static BS 8110 and EC2 applications in tension only using BS4449 grade B500B and B500C in accordance with CARES Appendix TA1-B

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 Grade B500B and B500C as detailed in the scope of application section 1.1

1.3 Conclusion

It is the opinion of CARES that APTUS Adjustable Coupler in the size range 20mm - 40mm 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.

Lee Brankley

L. Brankley
Chief Executive Officer
April 2022



2 Technical Specification

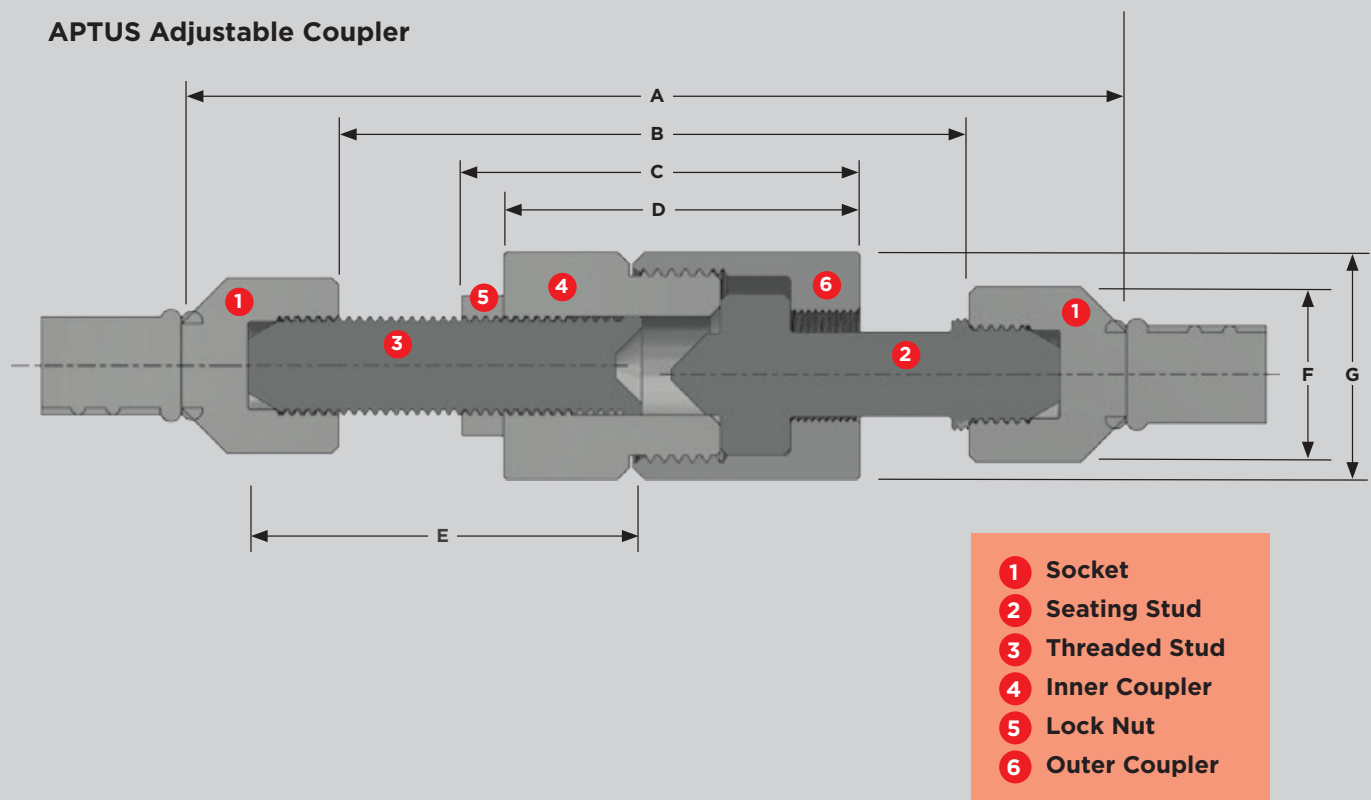
2.1 General

The APTUS Adjustable Coupler is designed for use with pre-cast concrete elements allowing for a faster, safer and more efficient way to design and construct. It is designed for use in the APTUS Adjustable Coupler System see pages 12 to 15 of this report for further information.

2.2 APTUS Adjustable Coupler

The APTUS Adjustable Coupler provides a mechanical connection of deformed Grade B500B and B500C high yield carbon steel bars for the reinforcement of concrete, complying with the tensile properties of BS4449.

APTUS Adjustable Coupler



Coupler Ref	Bar Dia mm	Thread Size	A mm	B mm	C mm	D mm	Tested Stud Length "E"		F mm	G mm
							B500C	B500B		
ACS N24	20	M28	270	180	114	102	112.5*	112.5 - 412**	50	65
ACS N24	25	M28	270	180	114	102	112.5*	112.5 - 412**	50	65
ACS N32	32	M36	300	180	114	102	127.5*	127.5 - 427**	60	75
ACS N40	40	M45	320	180	114	102	127.5*	127.5 - 427**	75	85

Table 1

* Denotes the single stud length used within the coupled assembly when tested using grade B500C Reinforcing steel for this report.

** Denotes the stud length range used within the coupled assembly when tested using grade B500B Reinforcing steel for this report.

3 Product Performance and Characteristics

3.1 Material Properties

Full destructive tests have been carried out to demonstrate compliance with the performance requirements defined in CARES Appendix TA1-B when used with reinforcing bars to BS4449 Grade B500B and B500C for APTUS Adjustable Coupler.

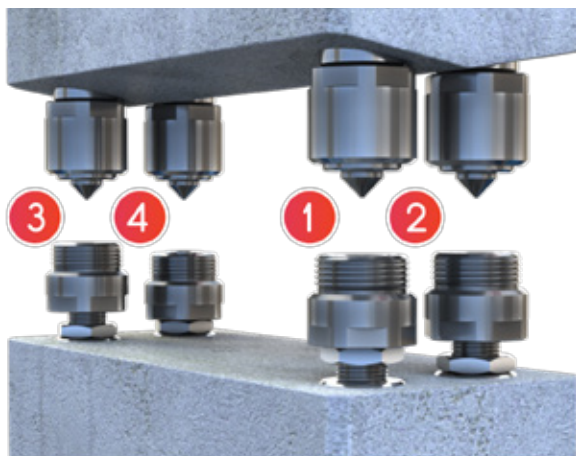
CARES APPENDIX TA1-B strength requirements

- Permanent deformation is less than 0.10mm after loading to $0.65 Re_{(char)}$ in tension or compression.
- 99% characteristic tensile strength is greater than 540 MPa with grade B500B reinforcement or 575 MPa with grade B500C reinforcement.



4 Installation

1



APTUS Adjustable Inner Couplers 1, 2, & 3 are set to the required RL

Inner Coupler 4 (and all other couplers) are wound down to avoid interference

Inner Coupler 1 is secured in position with its lock nut

2

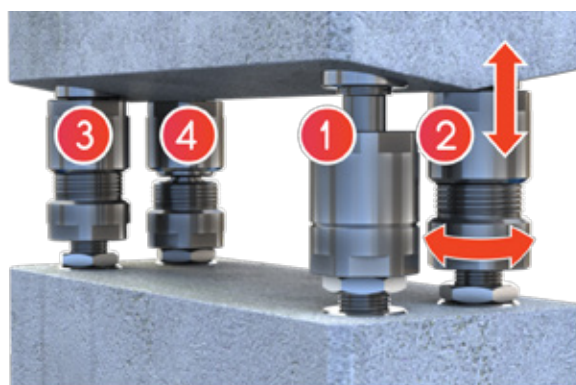


The precast element is lowered into position and seated onto the three pre-set couplers

Note Coupler 4 is not in position

Levelling of the precast element will utilise only three couplers

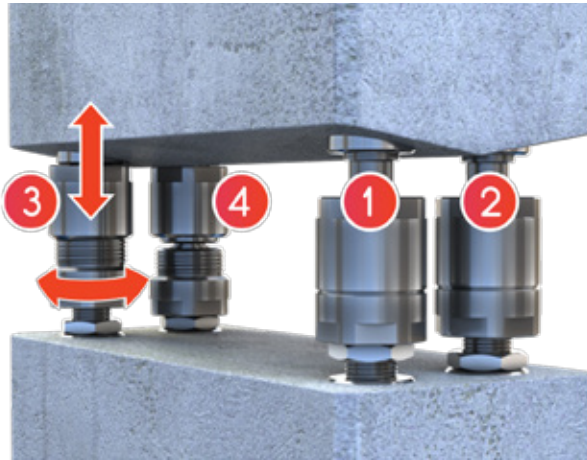
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APTUS Outer Coupler 1 is engaged with its Inner Coupler

Subject to the vertical alignment required in the first direction, Inner Coupler 2 is rotated left or right to lower or raise the precast element accordingly

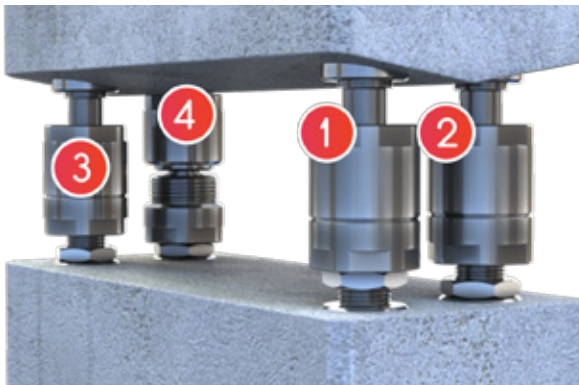
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When the required vertical alignment is achieved in the first direction, Outer Coupler 2 is engaged with its Inner Coupler

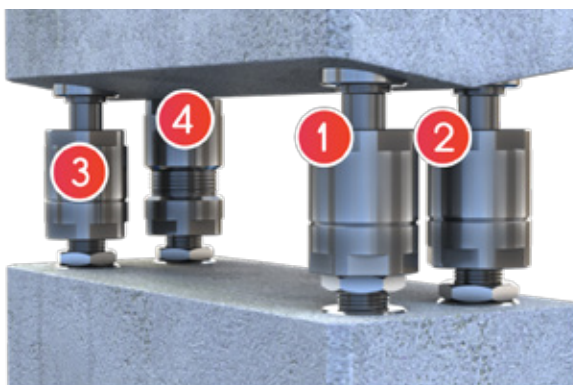
Subject to the vertical alignment required in the second direction, Inner Coupler 3 is rotated left or right to lower or raise the precast element accordingly in that direction

5



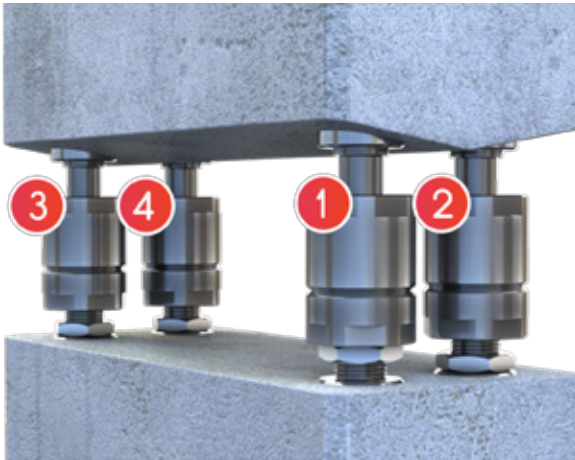
When the required vertical alignment is achieved in the second direction, Outer Coupler 3 is engaged with its Inner Coupler

6



APTUS Inner Coupler 4 (and all other couplers) can now be wound up to engage firmly against the Seating Stud

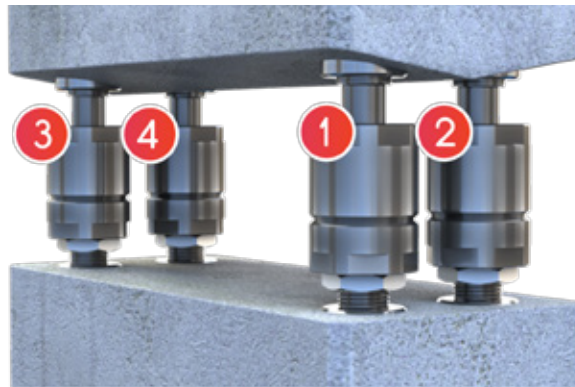
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**APTUS Adjustable Outer Coupler 4
is engaged with its Inner Coupler
(as with all other couplers)**

Crane can be disengaged

8



Secure all remaining Lock Nuts

5 Safety Considerations

APTUS Adjustable Couplers should be stored safely for mechanical handling. Units weighing up to 25Kg may be handled by one individual. Anything over this weight must be handled with appropriate lifting equipment. It is advisable to wear protective gloves during handling the containers, couplers and reinforcement during coupler installation.

On site, the usual safety precautions should be followed when handling re-bar and the use of gloves and other relevant PPE is always advised.

6 Product Testing and Evaluation

APTUS Adjustable Couplers have been tested to satisfy the requirements of CARES Appendix TA1-B for Couplers with reinforcing bars to BS4449 Grade B500B and B500C. The testing comprised the following elements:

- Tensile Strength
- Permanent Deformation

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

APTUS Adjustable 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

APTUS Adjustable Coupler, when used in EC2 based designs using the data contained within this technical approval, satisfy the relevant requirements of The Building Regulations (England and Wales), Approved Document A.

Materials and Workmanship, Approved Document

This technical approval gives assurance that the APTUS Adjustable Coupler comply with the material requirements of EC2.

8.2 The Building Regulations (Northern Ireland)

Materials and Workmanship

This technical approval gives assurance that APTUS Adjustable Coupler 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 APTUS Adjustable Coupler comply with the material requirements of EC2 by virtue of *Clause 0.8*.

Structure

APTUS Adjustable Coupler, 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.
- BS 8110: Part 1: 1997 (Revised 2005): Structural Use of Concrete, Code of Practice for Design and Construction.
- 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 BS 8110 Applications for Static Tension or Static Compression.
- BS EN 1992-1-1:2004 Eurocode 2 Design of concrete structures - General rules for buildings.



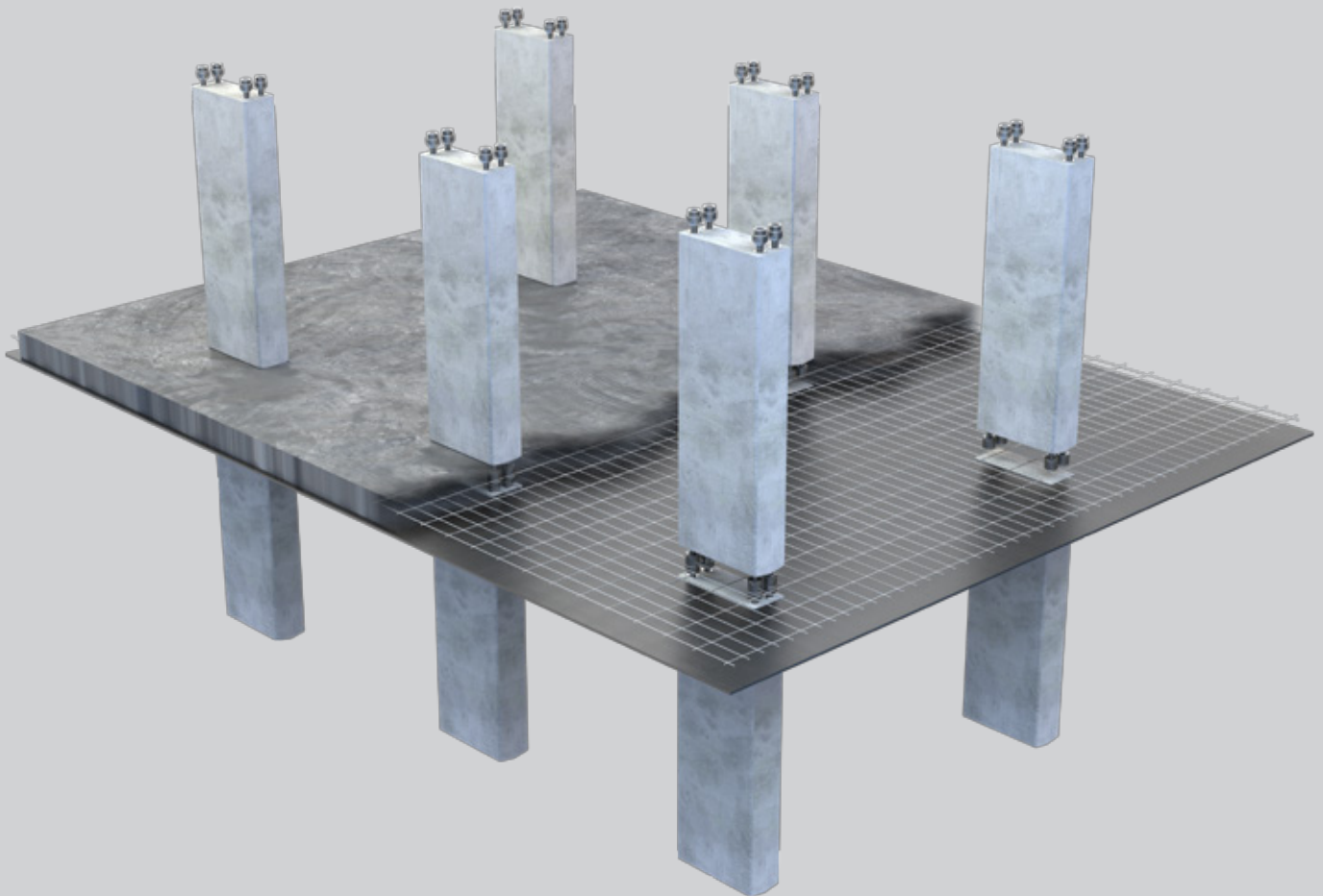
10 Conditions

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 provided 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 APTUS 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 are 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 etc 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 5074. Confirmation that this technical approval is current can be obtained from CARES.

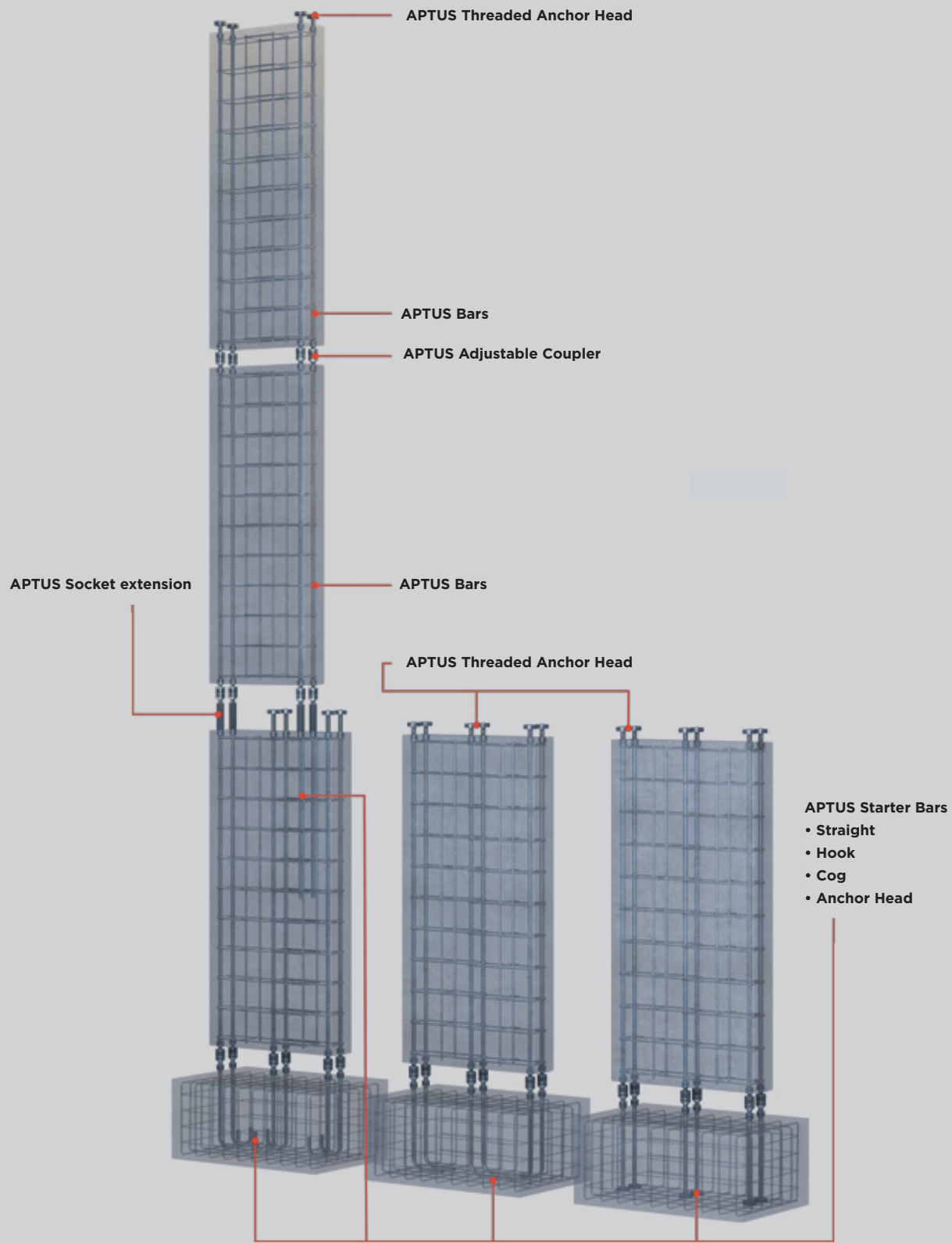
APTUS Adjustable Coupler System

The APTUS Adjustable Coupler is designed for use in the APTUS Adjustable Coupler System a faster, safer and more efficient way to design and construct precast vertical elements that are easy to manufacture and install. It eliminates the need for in situ trades associated with vertical elements such as steel fixers, formworkers, concreters, etc.

APTUS Adjustable Coupler System

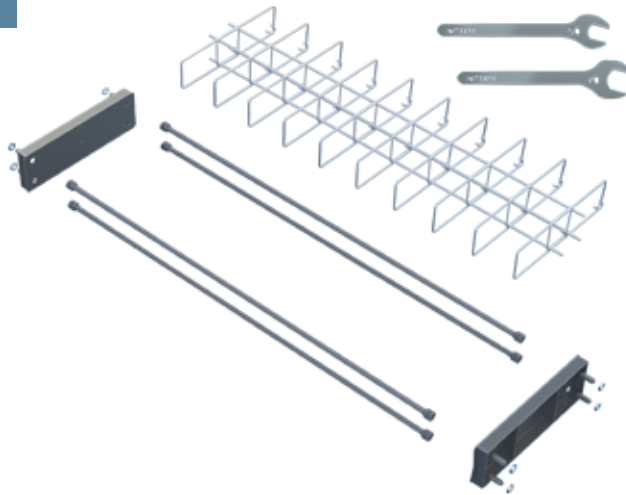


APTUS Adjustable Coupler System Elements



APTUS Adjustable Coupler System Fabrication Process

1

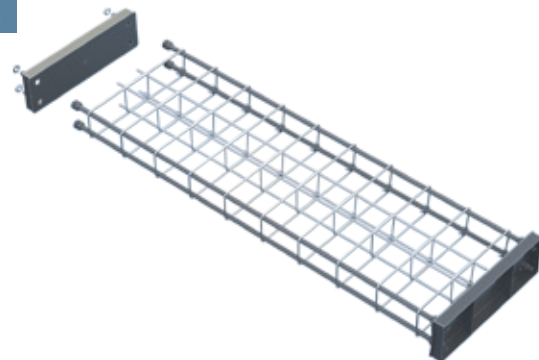


APTUS Bars, End Shutters & Fabrication Ancillaries supplied by APTUS

APTUS End Shutters can be fabricated by precast manufacturers themselves but must strictly adhere to APTUS specifications

Conventional reinforcing steel supplied by others

2

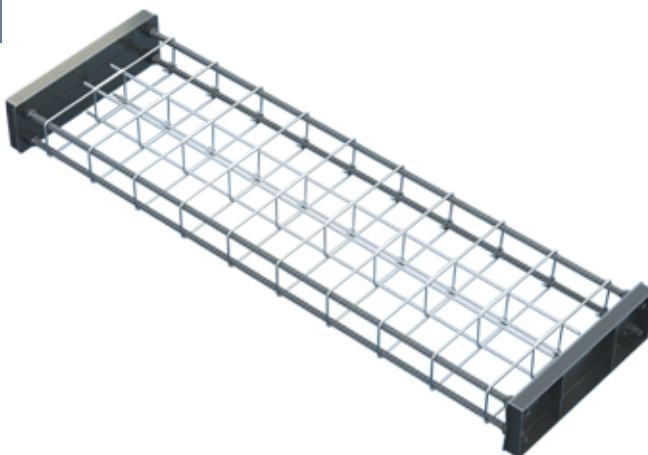


Always fix the bottom shutter to fabrication jig first, ensuring it is held square and secure

APTUS Bars can then be secured to the bottom shutter and conventional reinforcing steel placed loosely in position

Securing the APTUS bars to the bottom shutter first ensures the later fitment of the Outer Couplers is consistent - this provides for a much quicker installation process on site

3



The top shutter is then secured to the APTUS Bars and the conventional reinforcement fixed in position

There is no jig required to position the top shutter, it is simply held in position by the APTUS Bars

Any tolerance adjustment in the APTUS Bars ($\pm 5\text{mm}$) is always taken into account at the top of the precast element - any discrepancy is taken up later through the adjustment provided by the Inner Coupler

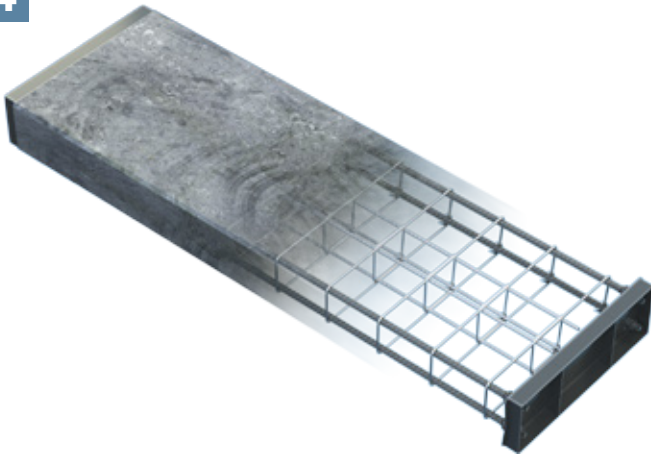


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4



The fabricated reinforcement cage is then placed on the casting bed

Industry standard side shutters are simply clamped in position against the top and bottom shutters on the casting bed

Standard concrete placement processes are then adopted in accordance with individual precast manufacturer's QA System

5



Following normal post-production procedures, Outer Coupler Assemblies are secured into the bottom of the precast element and Inner Coupler Assemblies are secured into the top of the element

Precast Elements are then placed into storage and are now ready for delivery to site



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