

**ESplice™**  
**Mechanical Splicing System**

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# NatSteel Holdings –

partnering the construction industry for over 40 years



E-Splice™ (standard) stud and coupler

**NatSteel Holdings**, a wholly-owned subsidiary of **Tata Steel** – the world's top ten largest steel producer, has supported the construction industry in Singapore for over 40 years.

We are the only steel mill in Singapore. Our downstream boasts one of the largest single prefabrication operations in the world, with a capacity of 400,000 metric tonnes for cut-and-bend and precaging.

Our steel products are widely used in the construction of residential, institutional, industrial and commercial buildings, as well as infrastructural works.

The NatSteel Holdings Group employs over 3,500 employees across Singapore, Australia, China, Malaysia, Philippines, Thailand and Vietnam. We have an annual production capacity of more than 2 million tonnes of high quality steel products that cater to the construction industry.

Today, NatSteel Holdings is well-placed to tap into Tata Steel's extensive resources to further expand in the region and achieve our vision of becoming a world-class steel producer.



### About E-Splice™

The E-Splice™ mechanical splicing system is a proprietary “BAR BREAK” mechanical splicing system designed to be used in the construction industry for splicing high tensile deformed (HTD) bars.

Through the use of friction-weld technology for joining mechanical couplers and threaded studs to HTD bars, the E-Splice™ mechanical splicing system is a high-performance mechanical splicing system with superior fatigue behaviour and higher ultimate strength than HTD bars.

E-Splice™ meets the requirements of major international design codes such as BS 8110, BS 6500 and ACI 318.

We supply E-Splice™ couplers, threaded studs and welded joints of consistently high quality through the use of fully automatic computer numerical control (CNC) machines. This ensures we produce consistently well-matched threads, unlike other threaded mechanical splicing systems which involve high amounts of manual labour in threading and quality checks.



### E-Splice™ (Standard) Mechanical Splicing System / Type A

The E-Splice™ standard coupler is designed for situations where the bar to be joined at a later stage is free to turn. It is ideal for use in all locations within the structure, such as columns, beams, slabs,

walls and foundations. It can also be prefabricated as part of bored pile cages, diaphragm wall cages, micropiles, etc.

Table 1: Approximate dimensions of standard couplers

Standard Coupler						
Size (mm)	16	20	25	28	32	40
Outer Diameter	25	30	36	40	46	55
Length	40	42	54	56	60	72
Threaded Length	20	22	27	28	30	36
Pitch	2.5	2.5	3	3	3	3.5
Standard Stud						
Size (mm)	16	20	25	28	32	40
Outer Diameter	19	22	28	30	34	42
Length	56	58	65	66	68	80
Threaded Length	20	22	27	28	30	36
Pitch	2.5	2.5	3	3	3	3.5

### E-Splice™ (Position) Mechanical Splicing System / Type B

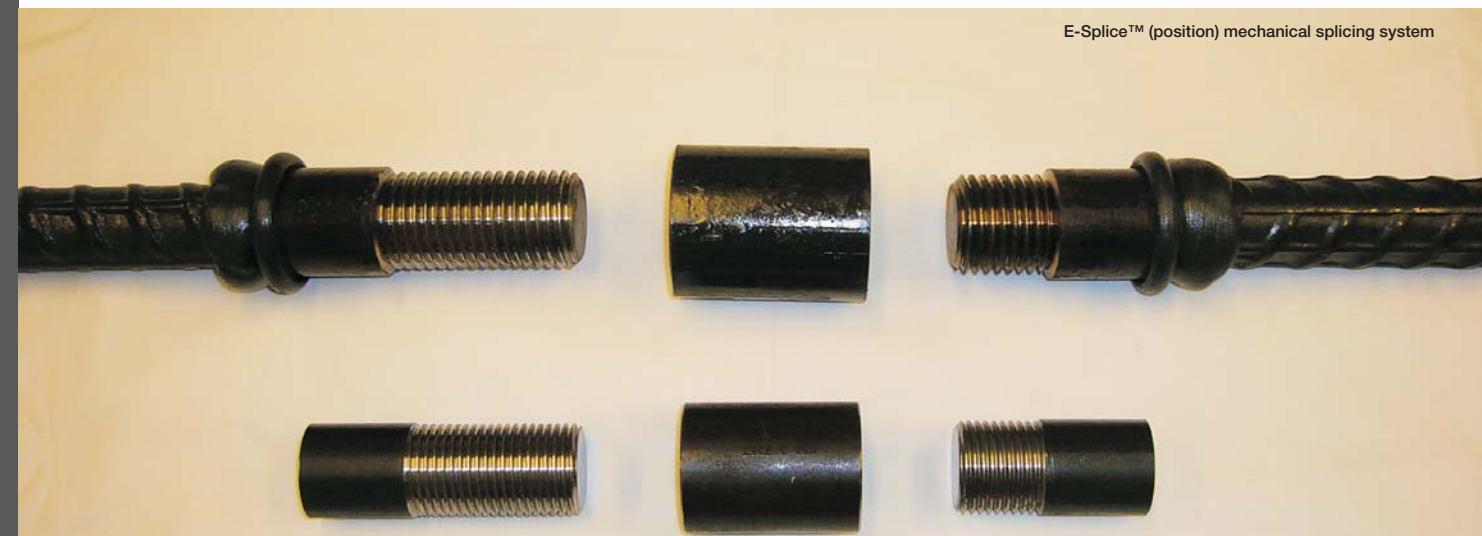
The E-Splice™ position coupler series is designed for all locations within the structure where the bar to be joined to the coupler at a later stage cannot or should not be turned.

It can be used for steel cages for columns, beams, bored piles, diaphragm walls, micropiles, etc.

Table 2: Approximate dimensions of position couplers

Extended Coupler						
Size (mm)	16	20	25	28	32	40
Outer Diameter	25	30	36	40	46	55
Length	42	46	56	58	62	74
Threaded Length	42	46	56	58	62	74
Pitch	2.5	2.5	3	3	3	3.5
Extended Stud						
Size (mm)	16	20	25	28	32	40
Outer Diameter	19	22	28	30	34	42
Length	76	80	92	94	98	116
Threaded Length	40	44	54	56	60	72
Pitch	2.5	2.5	3	3	3	3.5
Standard Stud						
Size (mm)	16	20	25	28	32	40
Outer Diameter	19	22	28	30	34	42
Length	56	58	65	66	68	80
Threaded Length	20	22	27	28	30	36
Pitch	2.5	2.5	3	3	3	3.5

All measurements in millimetres



## Friction-Weld Technology

Friction-weld (FRW) is a welding process that produces a weld under the compressive force contact of workpieces rotating relative to one another. It is a solid-state welding process in which joining occurs at a temperature below the melting points of the workpieces.

It can be used to join two pieces of similar or dissimilar metals of the same or different diameters, producing a joint that is much stronger than the strength of the weaker metal.

Since its successful introduction into commercial application in 1940, FRW technology has been widely-used in the high-end automotive, aerospace, defence, marine and oil industries for joining high-performance parts such as drive shafts, axles, gears, steering shafts, valves, shock absorbers, piston rods, track rollers, bushings, etc. High quality and performance standards of FRW technology have therefore been well-proven in the past decades.

Fig.1: Basic steps in friction-welding

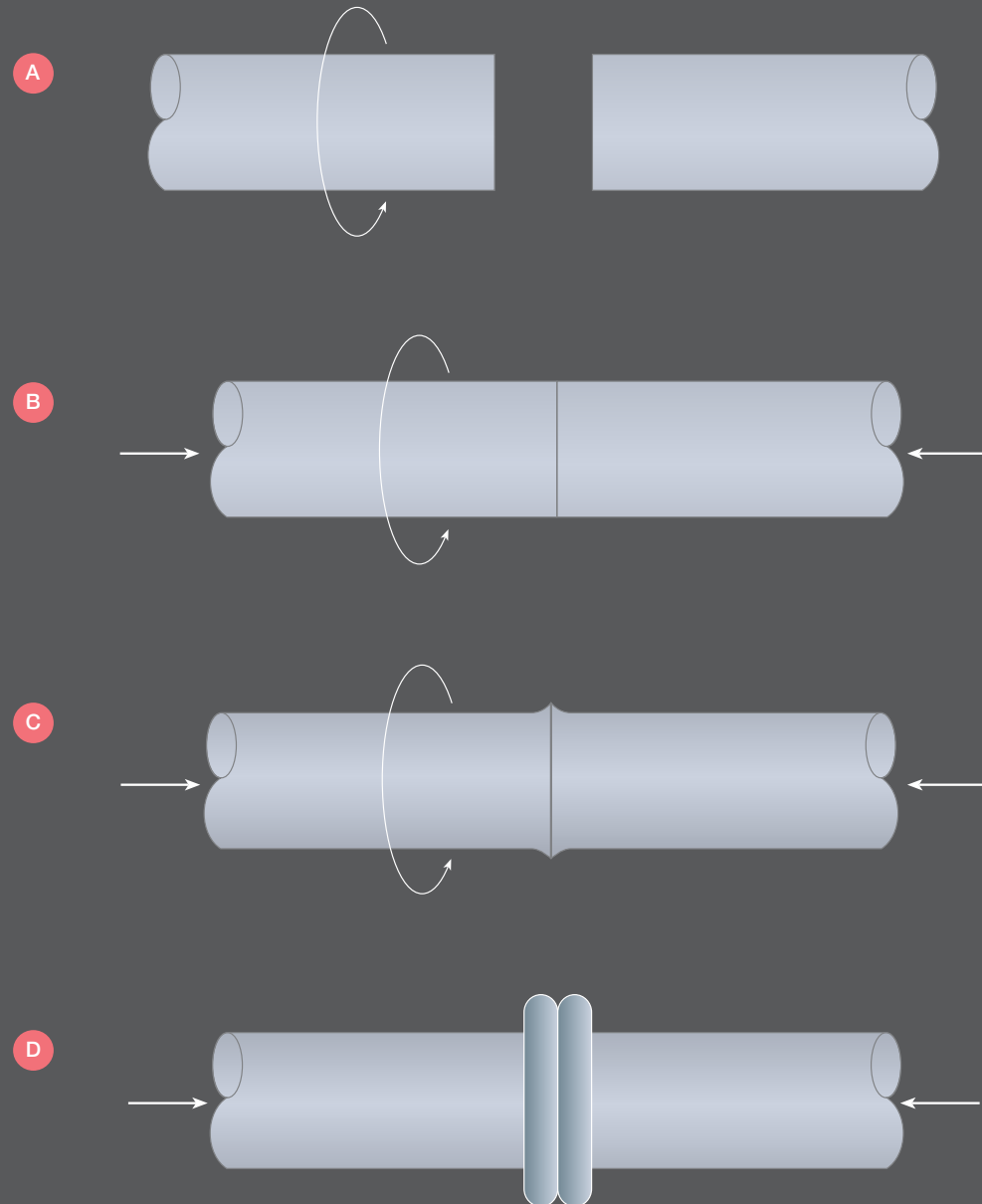
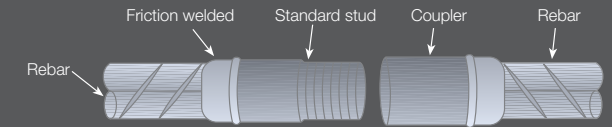


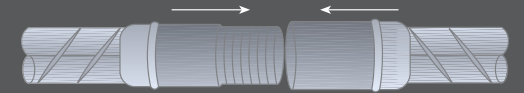
Table 3: Method statement for E-Splice™ (standard) mechanical splicing system / Type A

### Installation

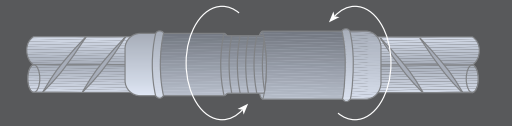
1 Take a reinforcement bar (rebar) friction-welded with a coupler and another rebar friction-welded with a standard stud



2 Place both rebars end-to-end



3 Position and turn either rebar to join both ends together



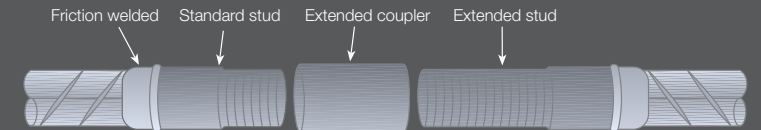
4 Tighten the joint between both rebars



Table 4: Method statement for E-Splice™ (position) mechanical splicing system / Type B

### Installation

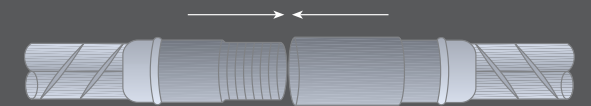
1 Take one rebar friction-welded with a standard stud and another rebar friction-welded with an extended stud. Place an extended coupler between the ends of both rebars.



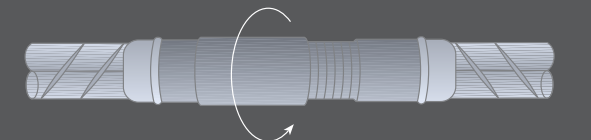
2 Align and turn the coupler to join the rebar with the extended stud



3 Position and install the rebar with the extended stud to the rebar with the standard stud



4 Join the extended coupler to the rebar with the standard stud



5 Tighten the joint by turning the extended coupler



### Advantages of using E-Splice™ Mechanical Splicing System

- **Greater reliability** as it does not depend on surrounding concrete for transfer of loads. Its ability to transfer loads is maintained even in weak or badly-placed concrete.
- **Reduces congestion** in lap zones, thus enhancing concrete flow, improving concrete quality and reducing the likelihood of costly repairs of unsound concrete
- **Reduces column size** to better utilise the floor space as it reduces the steel-to-concrete ratio in lap zones
- **Enhances construction speed** by replacing the slow and tedious traditional methods of planting starter bars (e.g. boxing-out or drilling through formwork in corewall construction, planting of starter bars into the soil in top-down construction)
- **Reduces rebar wastage** by better optimising bar usage, as E-Splice™ couplers are much shorter than bars with extra lap length
- **Reduces rebar usage** as every E-Splice™ coupler used replaces a lap bar which is more than 10 times heavier. This translates into benefits like better utilisation of limited site space, cutting down usage of hoisting facilities, lower handling cost and higher productivity.

Fig.2: Areas of application

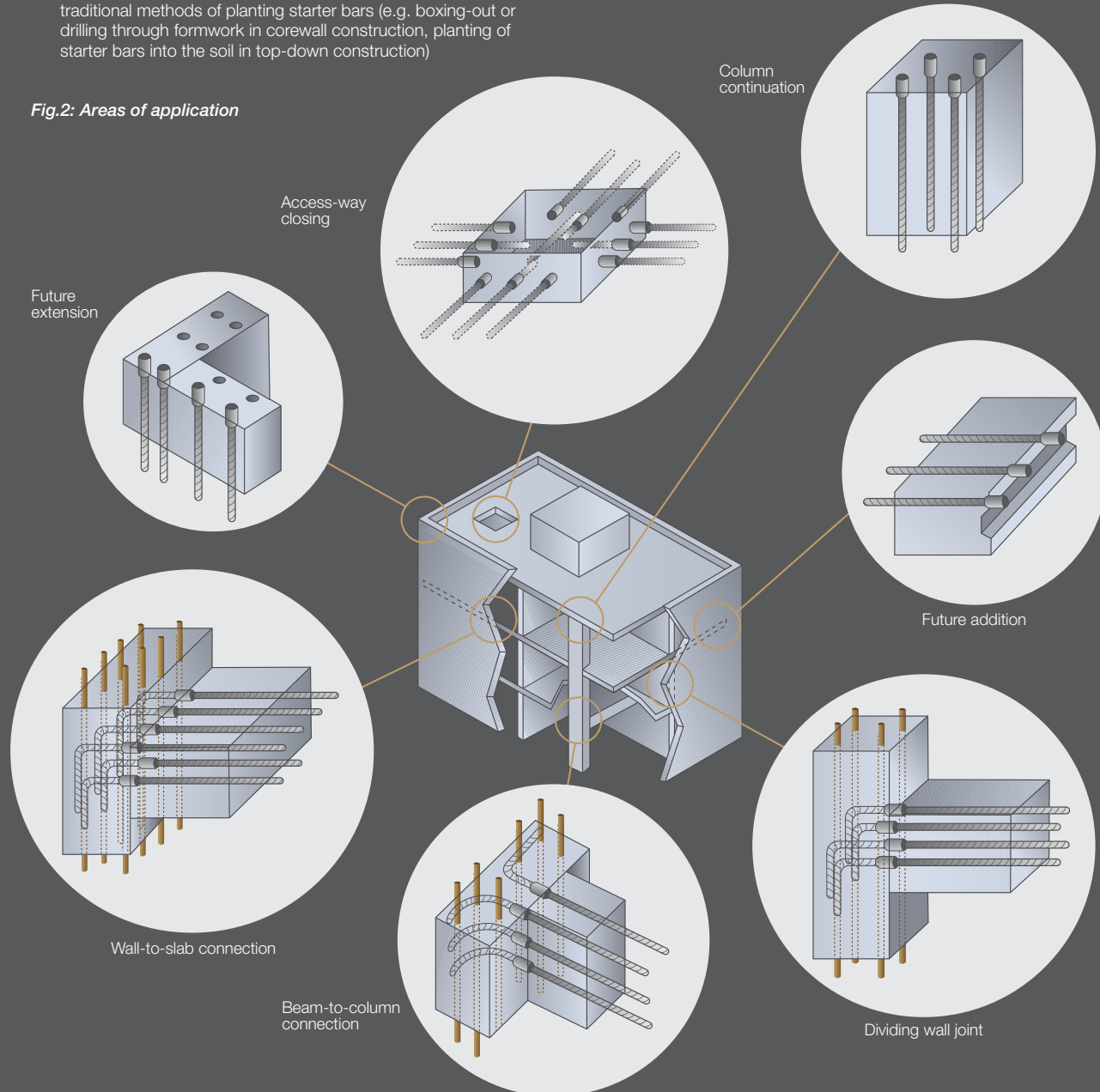


Table 5: Typical applications and benefits

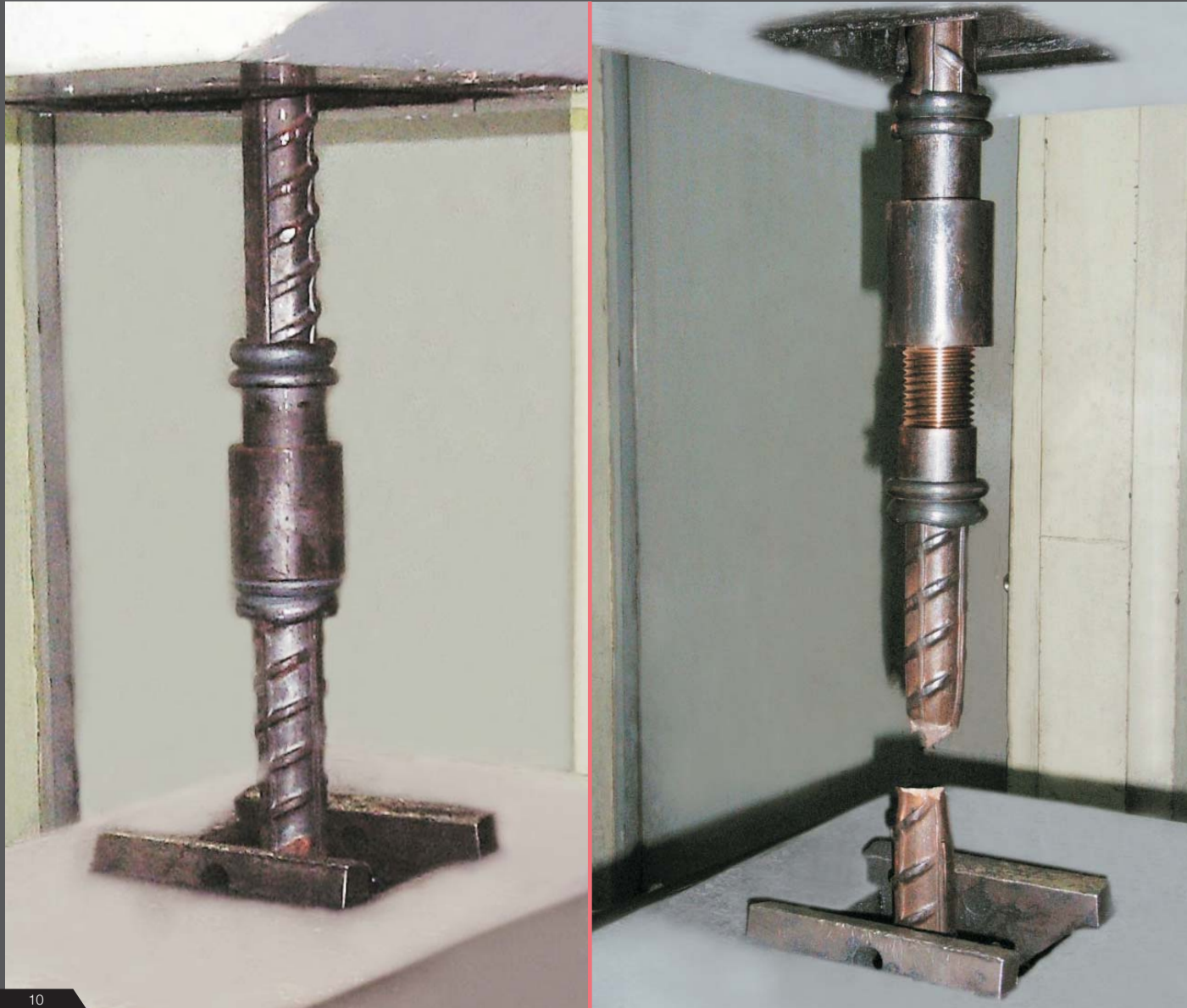
Area of application	Schematic diagram	Major benefits
<b>Corewall / beam connection</b>		<ol style="list-style-type: none"> <li>1. Saves cost and time on boxing-out and roughening</li> <li>2. Saves on cost of formwork and time as no drilling is needed</li> <li>3. Enables obstruction-free slipping of system formwork</li> <li>4. Reduces cycle time</li> </ol>
<b>Column lap-replacement</b>		<ol style="list-style-type: none"> <li>1. Reduces rebar wastage</li> <li>2. Reduces congestion</li> <li>3. Reduces column sizes, where possible</li> <li>4. Standardises bar lengths to simplify scheduling and installation</li> <li>5. Enables speedier construction</li> <li>6. Does not require cranking of bars</li> <li>7. Reduces rebar usage</li> </ol>
<b>Top-down construction</b>		<ol style="list-style-type: none"> <li>1. The fastest possible method</li> <li>2. Enables obstruction-free excavation</li> <li>3. Least influenced by wet weather</li> <li>4. Reduces congestion</li> <li>5. Reduces rebar wastage</li> <li>6. Does not require cranking of bars</li> <li>7. Reduces column sizes, where possible</li> <li>8. Reduces rebar usage</li> </ol>
<b>Future extension</b>		<ol style="list-style-type: none"> <li>1. Eliminates unsightly stumps or starters</li> <li>2. Allows screeding and waterproofing work to be done easily</li> <li>3. Allows easy extension</li> </ol>
<b>Precast elements (to eliminate starter bars)</b>		<ol style="list-style-type: none"> <li>1. Consists of smaller units, which mean easy and cheaper transportation</li> <li>2. Reduces likelihood of damage to starters due to handling, transportation or launching</li> </ol>

### Tension Load Testing of E-Splice™

Our E-Splice™ couplers undergo tension load tests according to the BS 8110, Part 1, 1997 standard.

During the test, a coupler sample is clamped on the Universal Testing Machine in a vertical position. A tension load is applied with increasing strength to the sample until it fractures. The maximum tensile load (the amount of force applied when the coupler fractures) is then recorded.

An E-Splice™ coupler sample fractures at the bar during the tension load test



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