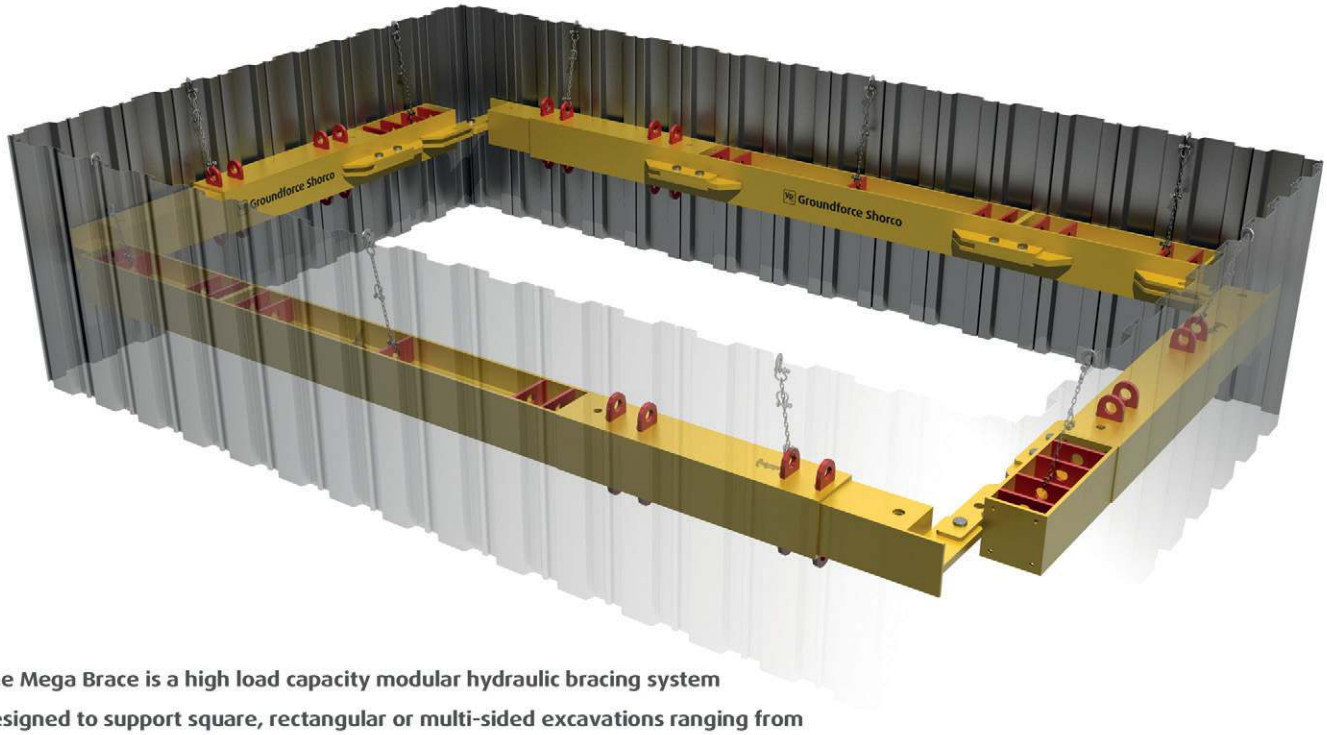
Mega Brace



The Mega Brace is a high load capacity modular hydraulic bracing system designed to support square, rectangular or multi-sided excavations ranging from 3.0m to 20.0m in plan. It comprises hydraulic unit for fine length adjustment connected to a series of modular fixed length extension pieces for course length adjustment, connected via a simple double pinned splice. The fixed length extensions can be connected together to form a continuous heavy-duty waling beam when used as part of an internally strutted frame.

Typical Applications

- Large Tanks - Interceptor, storage, fuel tank farms.
- Cofferdams, basements, bridge abutments.
- Reinforced Concrete Structures - Pumping Stations and Retaining walls.

Features / Benefits

- Modular format allows for easy installation of large frame configurations with relatively light duty lifting equipment.
- Pined joint and corner connections for quick assembly on site.
- Ideal for long excavations, where large clear spans are required.
- In built corner joint articulation enables the legs to be used for non-rectangular e.g. hexagonal excavations.
- Double acting hydraulics with integral mechanical lock off valve for ease of installation and removal with zero fluid loss.
- Full mechanical lock off system available on special order.

Product Link

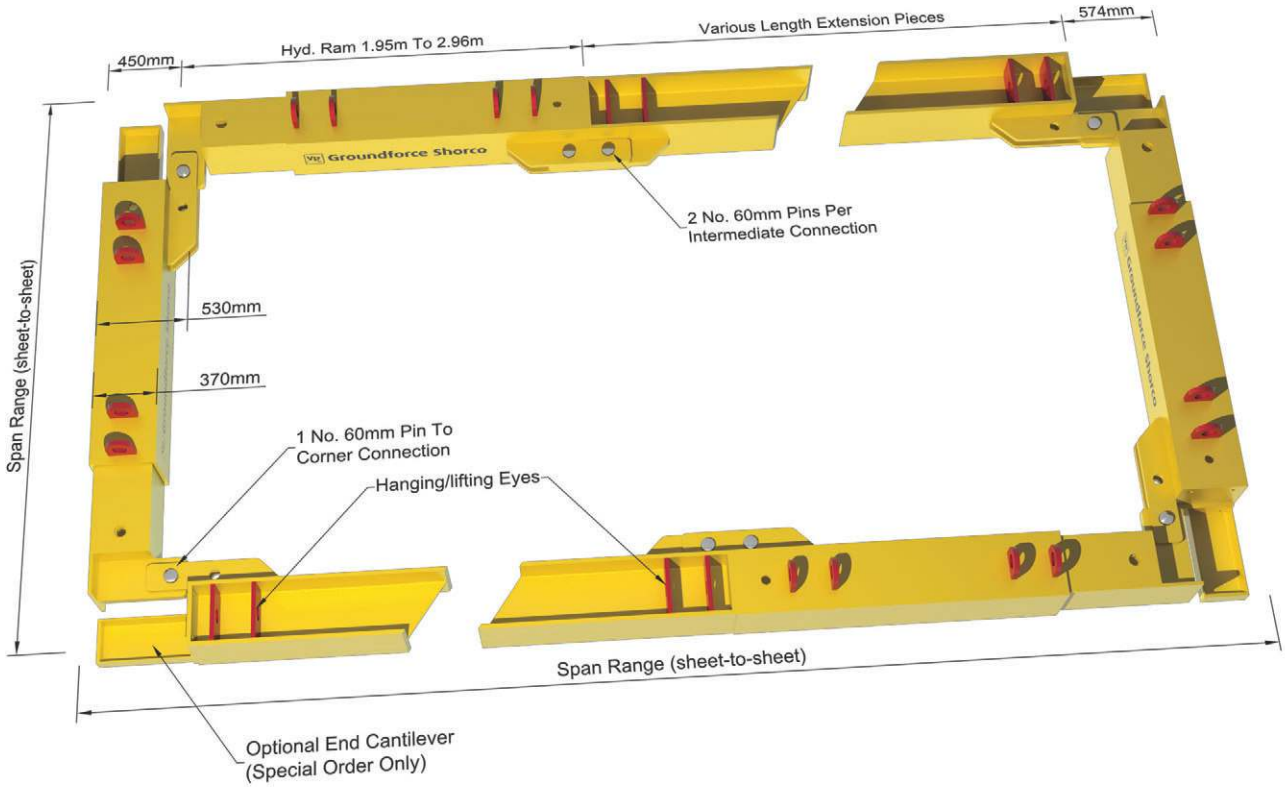
Brace Ancillaries - Section 3.3

Strut Ancillaries - Section 5.4

Compatibility

- Mega Brace legs are fully compatible with Maxi Brace legs. In addition the Mega Brace can be used with proprietary mechanical or hydraulic struts, subject to detailed design checks, to increase the overall load capacity of the waling beam. The Mega beam can also be used as the waling in raking strut systems, see section 5.5.

General Arrangement of Typical Mega Brace Frame



The beam section width is 370mm and the overall section width, inclusive of the joint connection cleats, is 530mm. Therefore:

- Clear opening between beams = sheet-to-sheet dimension less 740mm.
- Clear opening between connections = sheet-to-sheet dimension less 1060mm.

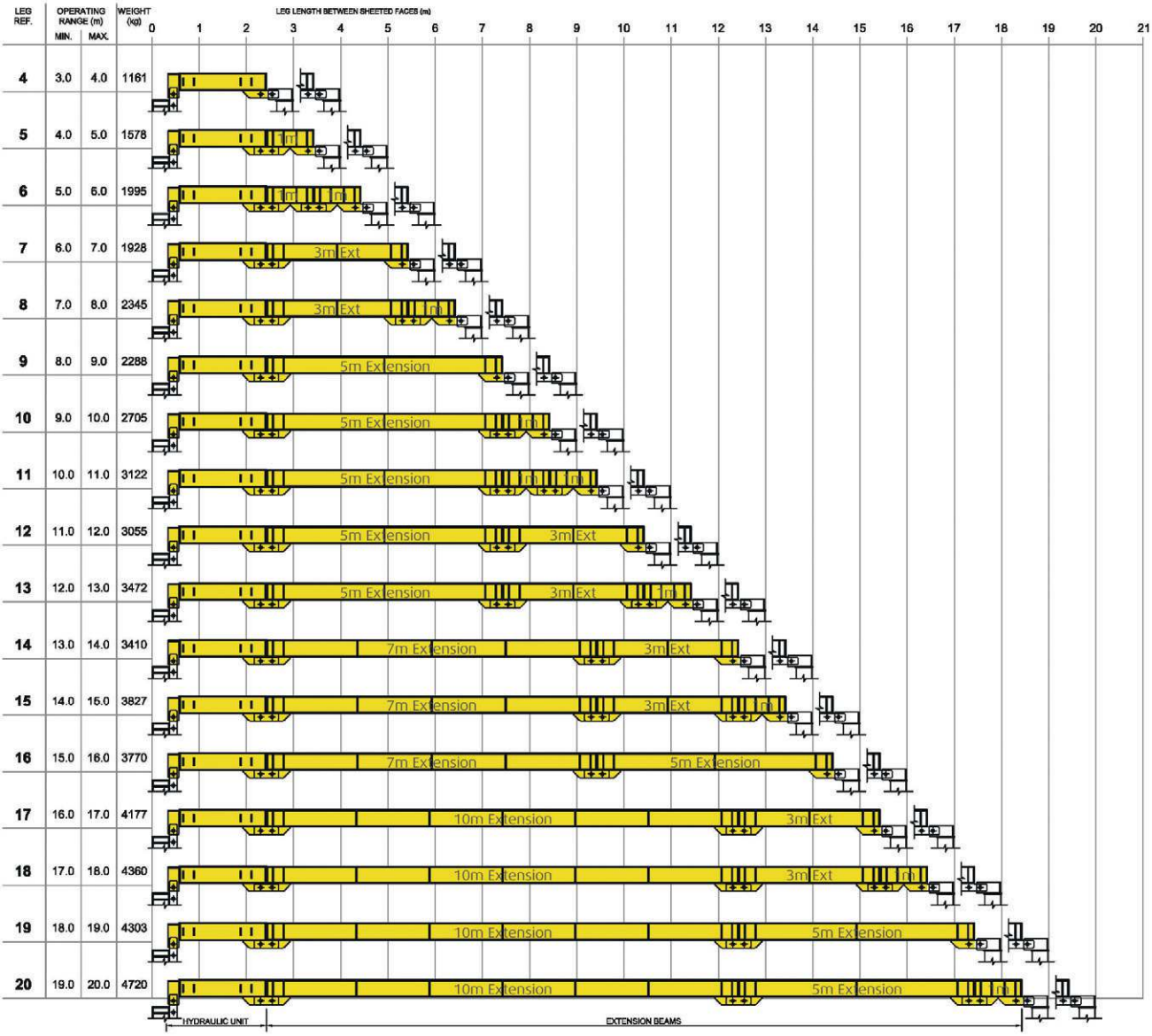
Note: An additional allowance for the inward deflection of the brace should be taken into account when provision of a minimum clear opening is critical, such as in the case of an excavation required to install a prefabricated tank (see graph on 3.1.5).

Joint details.

All mega brace joints use a simple pinned system. Corner connections are made with 1 No. 60mm Ø ref 6 pin

Intermediate spliced joint connections between extension pieces are made with 2 No. 60mm Ø ref 6 pins. Significant moment capacity can be thus achieved, all be it in the inward direction only. See data on 3.1.4.

Data table for assembled standard leg configurations



Mega Brace legs comprise a double acting hydraulic ram unit (with a stroke of 1m) and a series of fixed length extension sections which are connected together to obtain the desired brace length. The above chart provides information relating to the individual configurations of brace legs. The list is not exhaustive as certain legs can be made up with alternative combinations of extension units.

e.g. A Mega leg 15 can be achieved with either:

a) A ram unit, 5.0m extension, 5.0m extension and 1.0m extension, or

b) A ram unit, 5.0m extension, 3.0m extension and 3.0m extension, or

c) A ram unit, 10.0m extension, and 1.0m extension,

d) The configuration indicated in the table.

Note: Individual clear spanning Mega Brace legs should **not** contain more than three extension units unless part of an internally strutted frame for which a detailed scheme must be provided by a qualified engineer. Please contact Groundforce Technical Services for more advice.

Mega Brace

Technical Specification - extension sections.

- **Bending:** Working **moment capacities** of the extension beam section.
  - **888kNm** - inward bending.
  - **800kNm** - reverse bending.
- **Bearing:** All Groundforce struts up to 250 tonnes capacity can be safely applied to the front flange of the mega brace beam without risk of web buckling, irrespective of the strut location in relation to the web stiffeners.

Other factors which influence the overall working load capacity of the leg assembly

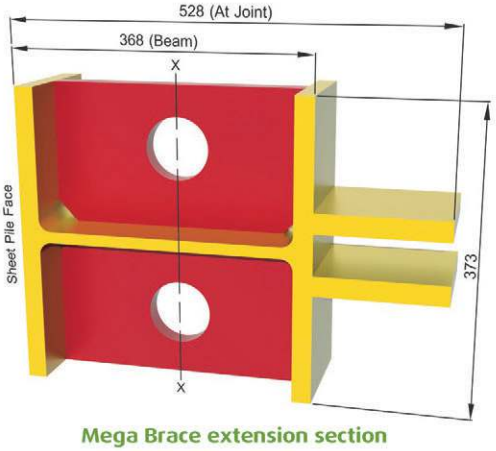
- **Pin joint:** Working moment capacities (in the X-X plane).
  - **667kNm** - inward bending.
  - **0kNm** - reverse bending.

Note: Two versions of hydraulic ram are used in mega brace. Early rams have a working axial load capacity of **400kN**; later rams have been up-rated to **500kN.** Both rams have a minimum factor of safety of **2:1** at maximum stroke.

- **Connecting pin details** (GF ref 6): 60mm Ø, 605M36T (EN16T) alloy steel
  - Shear / bearing / bending capacity (working) = 1232kN (in double shear).

Design Notes and assumptions:

- Refer to section 'i' for definition of terms and basis of loading
- All bending data is about the major axis X-X as indicated on the section above and includes a global factor of safety of 1.5 from ultimate limit state values
- Design verification of clear spanning mega legs can be undertaken by either carrying out individual checks on the capacity of the beam, the capacity of the joint(s) in the leg's assembled configuration and the capacity of the hydraulic ram. Alternatively by simply using the load chart on page 3.1.5 which takes these factors into account for standard assembly configurations.
- Where cross strutting is required, struts must be carefully located so as not to induce reverse bending across a joint. Consideration also needs to be given to the differing hogging and sagging moment capacities of the beam as stated above.
- The bending moment capacities specified above have been calculated using the following assumptions.
  - The flange of the beam in contact with the piled face is assumed to be fully restrained against lateral torsional buckling effects.
  - Bending due to self weight and accidental loading are ignored as it is assumed that the mega brace is supported with chain hangers or brackets at regular intervals along its length in accordance with the recommendations stated within the user guide.
  - Coincident axial loading can have a significant effect on the bending capacity of the mega beam. This is particularly significant in knee braced frame configurations where welded shear stops or clamps (see photo above) attached to the waling restrain the strut against longitudinal movement. It is recommended that a first principal assessment of beam capacity is made where coincident axial load exceeds 500kN. Contact the technical department for more advice.
  - The reverse bending or hogging moment value for the beam quoted above considers potential buckling of the inner compression flange taking into account load application is "destabilizing". Web stiffeners are assumed to provide a degree of lateral and torsional restraint to this flange.
- Bearing loads applied to the inner flange between stiffener locations (in cross strut applications) are limited by web strength in relation to the "stiff bearing length". First principal checks are recommended where strut loads exceed 2500kN. Contact the Technical Department for more advice.



Mega Brace extension section

ex 356x368x177 UC - Grade S460 steel

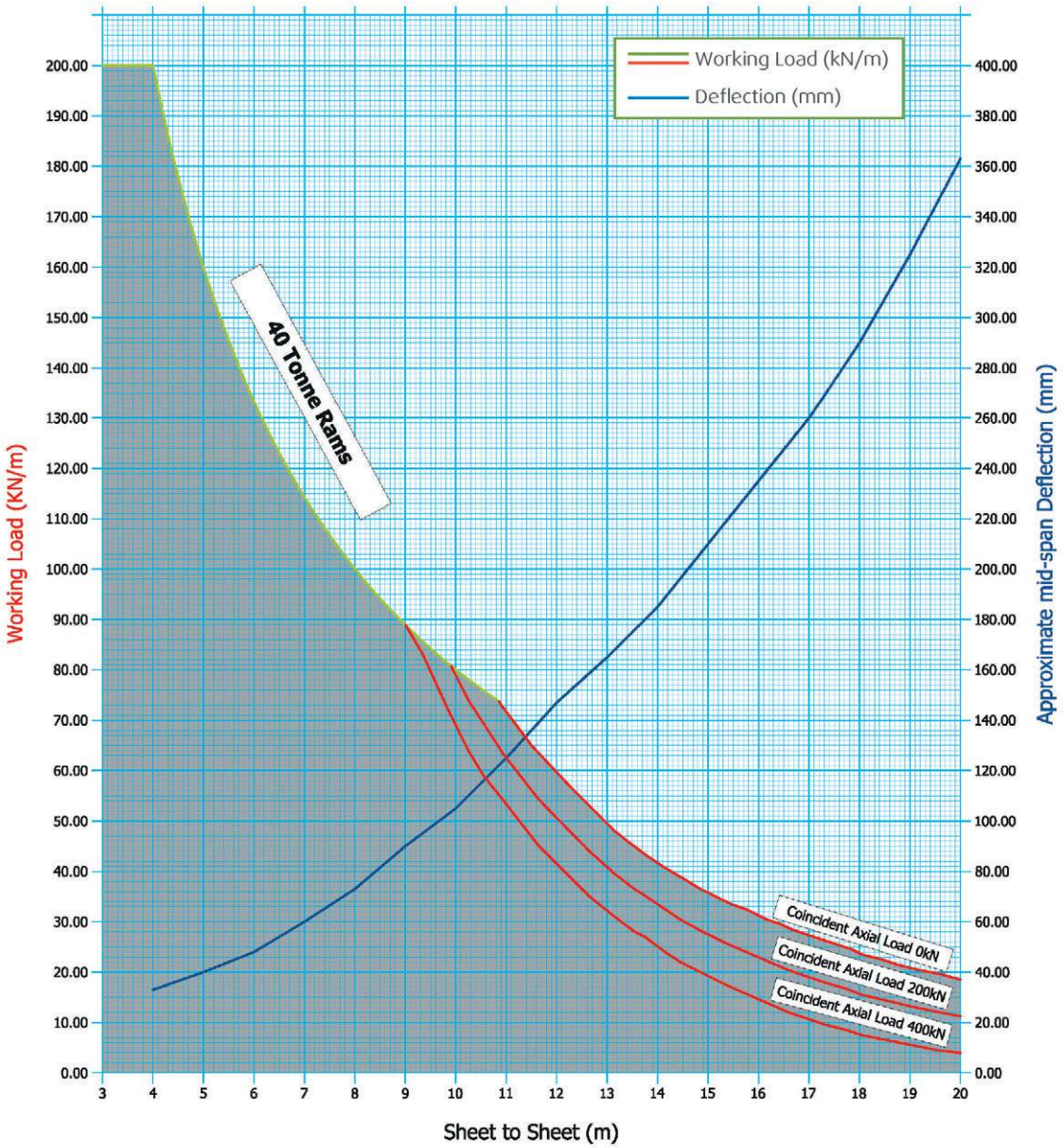
Schedule of Component Weights:	
Description	**Weight per item (kg)**
Hydraulic Unit	1120
1.0m Extension	410
1.5m Extension	585
3.0m Extension	760
5.0m Extension	1120
7.0m Extension	1485
10.0m Extension	2075
End Cantilever bracket	30

Mega Brace Performance Chart for 40T ram units - refer to section 'i' for definition of terms

Mega Brace legs act primarily as flexural members designed to resist inward bending due to lateral earth pressures. As the assembled frames support load on 4-sides, coincident axial load generated by perpendicular connecting legs is also taken into account; although this has only a relatively minor effect since axial capacity of individual legs is limited by the hydraulic ram. Refer to the introduction section for more explanation and a summary of load effects included within the design curve presented below.

The chart below indicates the load and deflection performance of clear span i.e. non-strutted Mega Brace waling beams across its full span range. The darker shaded area represents the envelope in which any given Mega Brace leg will perform safely. Ultimate values of resistance have been calculated in accordance with BS 5950 and these have been reduced by a lumped load factor of 1.5 to produce working load values. At shorter spans, the load capacity is restricted by the axial capacity of the integral hydraulic ram unit.

The Three Red Lines indicate the working load limit of Mega Brace legs with coincident axial loads of zero, 200kN and 400kN induced in them by the secondary legs. These lines govern the WLL of the Mega Brace legs between spans of approximately 11.0m to 20.0m. The Green Line is the WLL governed by the 400kN axial load capacity of the secondary legs as limited by the hydraulic ram. This line governs the WLL of the Mega Brace between spans of approximately 3.0m and 11.0m. The Blue Line indicates the approximate worst case (inward) deflection of a Mega beam calculated at mid-span under working load limit conditions. **Note:** This graph does not apply to cross strutted configurations. The working load capacity of these is produced on a scheme specific basis. See notes on P4. For further information contact the Technical Services Department.

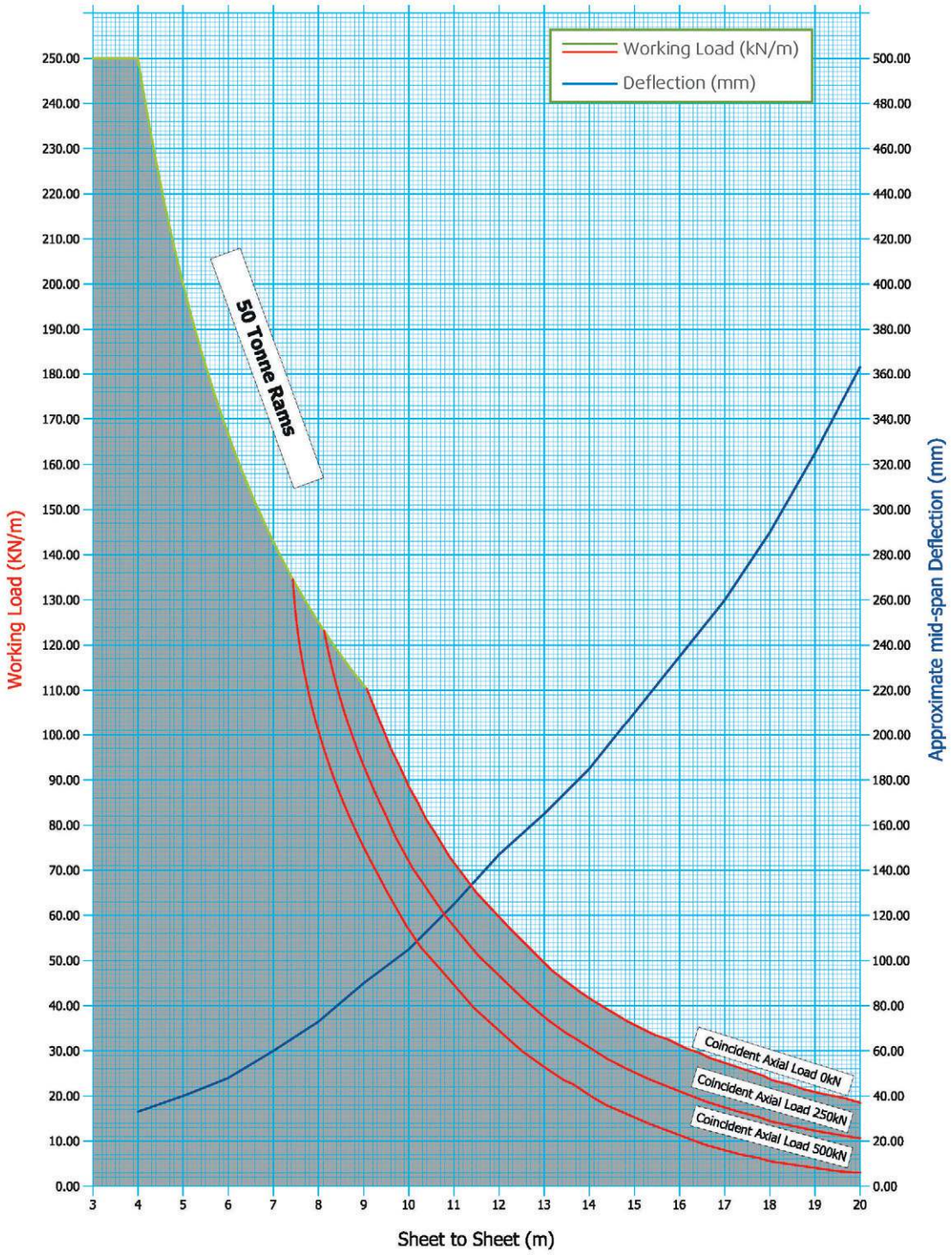


Mega Brace Performance Chart for 50T ram units - refer to section 'i' for definition of terms

The latest Mega Brace rams incorporate a 500kN or 50T hydraulic ram to improve performance, particularly at shorter spans where axial compression is a limiting feature. All other leg details remain the same and 40T and 50T units are interchangeable.

The performance chart for legs incorporating 50T rams is shown below, this is also represented by a matrix chart which explains potential modes of failure at various spans and configurations.

Note: The two hydraulic units appear virtually identical except for a "MEGA 50T" stencil on the 50T ram units.



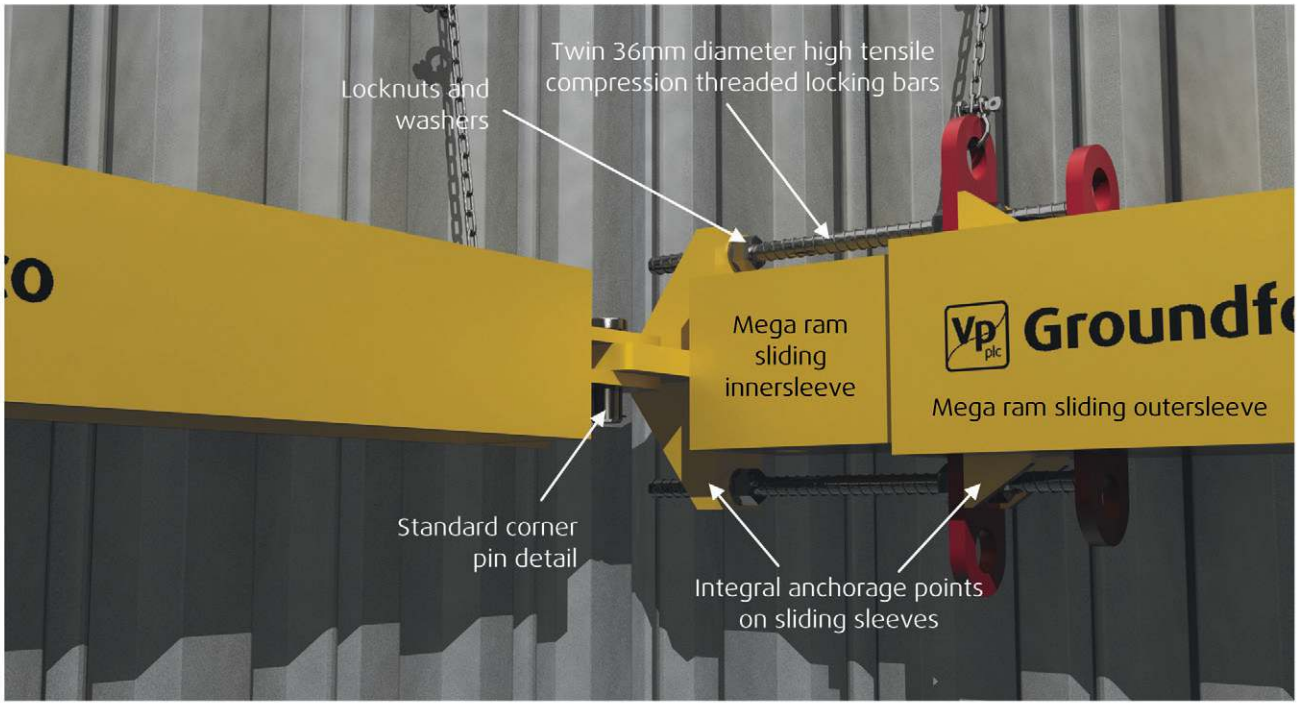
Mechanical lock-off system

As a special order option only, the hydraulic unit on 500kN mega rams can be fitted with locking rods to effectively isolate the hydraulic ram after installation and pressurisation. The system has been designed to give ultimate peace of mind in highly sensitive situations where it is considered not acceptable to rely on hydraulic pressure alone to support load.

A pair of high tensile 36mm diameter threaded rods are inserted through anchor plates welded to both the sliding inner and outersleeves on the hydraulic unit. After insertion, the rods are secured with locking nuts either side of the thrust plates. Heavy duty rubber washers are inserted on the compression thrust faces to introduce a small amount of flexibility into the system so the rods do not immediately attract all the load (being more rigid than the hydraulic ram)

Note: this system is designed as an emergency failsafe feature to come into play in the extremely unlikely event of hydraulic ram failure. The design (in compression) of the locking rods includes for a reduced factor of safety of 1.2 to reflect this. **Note that this feature is not available on all ram units and is therefore subject to special order only and at additional cost.**

General Arrangement of Components



Note: The locking rods act as a secondary restraining system in the unlikely event of ram failure. Hard rubber washers are inserted under steel washers on the thrust side of the rods as shown opposite. These washers allow a small amount of axial movement within the locking system so as to permit any subsequent (geotechnical) load increase after installation to be distributed back into the hydraulic ram; which is the main load bearing component.