

Manually operated hydraulic shoring systems for groundwork support —

Part 1: Product specifications

The European Standard EN 14653-1:2005 has the status of a
British Standard

ICS 93.020

National foreword

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 58, an inside back cover and a back cover.

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Manually operated hydraulic shoring systems for groundwork support - Part 1: Product specifications

Composants des blindages de tranchées - Partie 1:
Spécifications du produit

Manuell gesteuerte hydraulische Grabenverbaugeräte - Teil
1: Produktfestlegungen

This European Standard was approved by CEN on 28 February 2005.

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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 14653-1:2005) has been prepared by Technical Committee CEN/TC 53 “Temporary works equipment”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

This European Standard with the general title *Manually operated hydraulically shoring systems for groundwork support* consists of the following parts:

Part 1: Product specifications

Part 2: Assessment by calculation or test

These standards are to be read in conjunction with EN 12811-2 and EN 12811-3.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Hydraulically operated shoring systems comprise prefabricated equipment that supports sheeting to the sides of excavations. This document covers two types of equipment whose adjustment in length is by hydraulic or by a combination of hydraulic and mechanical means:

- a) hydraulic bracing frames;
- b) hydraulic waler frames.

A variety of components which when assembled form a full system. The prefabricated components are used to make frame assemblies of different dimensions and structural capacities.

Hydraulic bracing frames and waler frames have two strength classification classes - Class A and Class B.

Class B hydraulic bracing frame legs have a further restriction limiting the length of a single leg to 20 m.

The instruction manual is intended to provide all the necessary information on the safe use of the systems.

This document gives specific requirements on the main characteristics of manually operated hydraulic pumps, hoses and associated equipment, but does not provide requirements for their specification or assessment in EN 14653-2.

This equipment is frequently used in conjunction with supplementary equipment, e.g. knee braces and intermediate hydraulic bracing struts.

The characteristic resistance values specified in this document form various reference levels.

Annex A gives information about the values of Partial safety factor for materials γ_M and Partial safety factor for actions γ_F . Annex B gives information on their use under site conditions.

1 Scope

This document specifies constructional and structural requirements for manually operated hydraulic shoring systems made from steel and aluminium for groundwork support.

It specifies characteristic resistances for the equipment.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 853, *Rubber hoses and hose assemblies — Wire braid reinforced hydraulic type — Specification*

EN 856, *Rubber hoses and hose assemblies — Rubber-covered spiral wire reinforced hydraulic type — Specification*

EN 857, *Rubber hoses and hose assemblies — Wire braid reinforced compact type for hydraulic applications — Specification*

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10216 (all parts), *Seamless steel tubes for pressure purposes — Technical delivery conditions*

EN 10217 (all parts), *Welded steel tubes for pressure purposes — Technical delivery conditions*

EN 10305 (all parts), *Steel tubes for precision applications — Technical delivery conditions*

EN 12811-2, *Temporary works equipment — Part 2: Information on materials*

EN 14653-2, *Manually operated hydraulically shoring systems for groundwork support — Part 2: Assessment by calculation or test*

ENV 1993-1-1, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

ENV 1999-1-1, *Eurocode 9: Design of aluminium structures — Part 1-1: General rules — General rules and rules for buildings*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs (ISO 898-1:1999)*

EN ISO 4287, *Geometric product specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (ISO 4287:1997)*

ISO 10100, *Hydraulic fluid power — Cylinders — Acceptance tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 rams

3.1.1 hydraulic ram

adjustable component that withstands force and whose length can be varied by the application of hydraulic pressure (see Figure 1, Figure 2 and Figure 3)

NOTE 1 A separate manually operated pump activates the ram.

NOTE 2 The term 'ram' has been adopted to distinguish the component from the more general term 'cylinder'. Rams only receive static loading from ground pressure and do not require specific duty cycles or cycle rates.

3.1.2 single acting ram (SA)

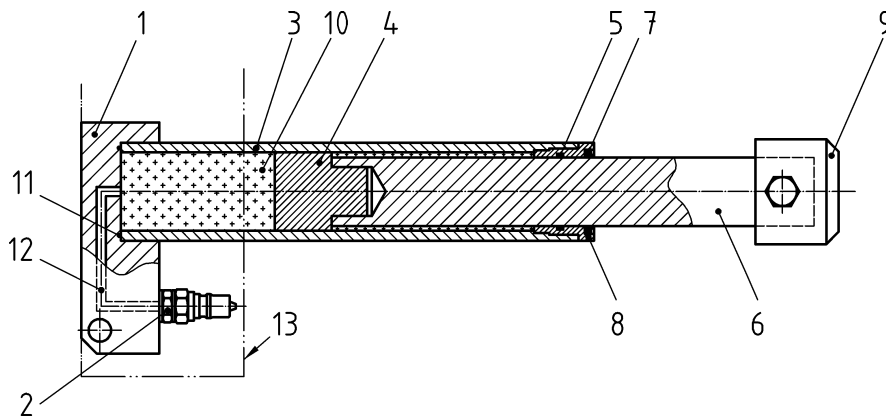
hydraulic ram that under hydraulic pressure only extends and cannot retract hydraulically

NOTE 1 A single acting ram can only support compressive forces.

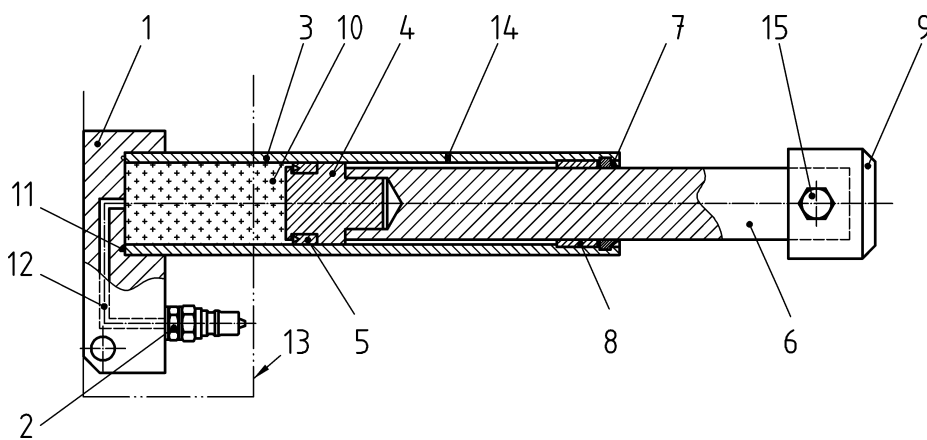
NOTE 2 There are three types of single acting ram available a, b and c (see Figures 1 and 2).

- a) Displacement type (D) see Figure 1 a);
- b) Piston type (P) see Figure 1 b);
- c) Multi-stage rams; these rams may be piston types, displacement types or a combination of both (M).

NOTE 3 A single acting ram may be supplied with a mechanical spring return (**SR**), which provides a double-acting action without the requirement for a hydraulic return. The spring takes effect when the hydraulic pressure is released, (see Figure 2).

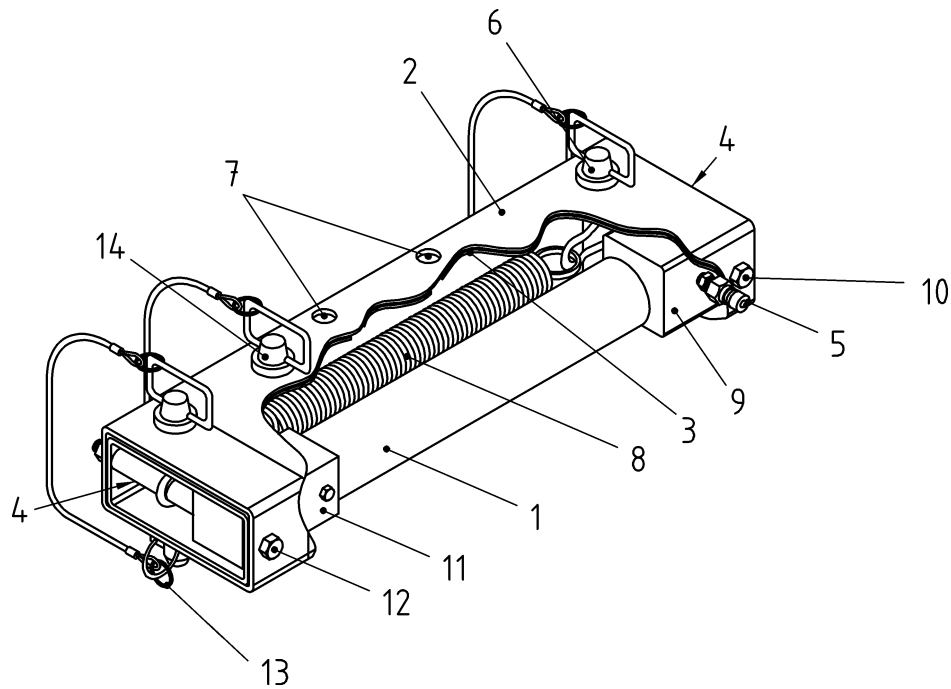
**Key**

- | | | | |
|---|----------------------------|----|-----------------------------|
| 1 | Cylinder end block | 8 | Gland |
| 2 | Male quick release coupler | 9 | Piston rod end block |
| 3 | Cylinder tube | 10 | Full bore side of piston |
| 4 | Bypass piston | 11 | 'O' ring seal |
| 5 | Seal | 12 | Location of optional valves |
| 6 | Piston rod | 13 | Water rail |
| 7 | Wiper ring | | |

a) Example of a displacement type ram**Key**

- | | | | |
|---|----------------------------|----|-----------------------------|
| 1 | Cylinder end block | 8 | Gland |
| 2 | Male quick release coupler | 9 | Piston rod end block |
| 3 | Cylinder tube | 10 | Full bore side of piston |
| 4 | Sealed piston | 11 | 'O' ring seal |
| 5 | Seal | 12 | Location of optional valves |
| 6 | Piston rod | 13 | Water rail |
| 7 | Wiper ring | 14 | Blow-off hole |
| | | 15 | Mounting bolt or pin |

b) Example of a sealed piston type ram**Figure 1 — Examples of single acting rams**



Key

- | | |
|--|-----------------------------------|
| 1 Single acting ram | 8 Return spring |
| 2 Outer section | 9 Cylinder end block |
| 3 Inner section | 10 End block pin |
| 4 Waler rail is positioned at both ends 90° to the strut | 11 Piston rod end block |
| 5 Quick release coupler | 12 Non-load bearing mounting bolt |
| 6 Rail pin | 13 Retaining clip |
| 7 Alternative locking pin positions | 14 Locking pin |

Figure 2 — Example of a telescopic waler strut with spring return

3.1.3

double acting ram (DA)

hydraulic ram that both extends and retracts under hydraulic pressure (see Figure 3)

NOTE These rams primarily take compressive loads but also have a tensile capacity.

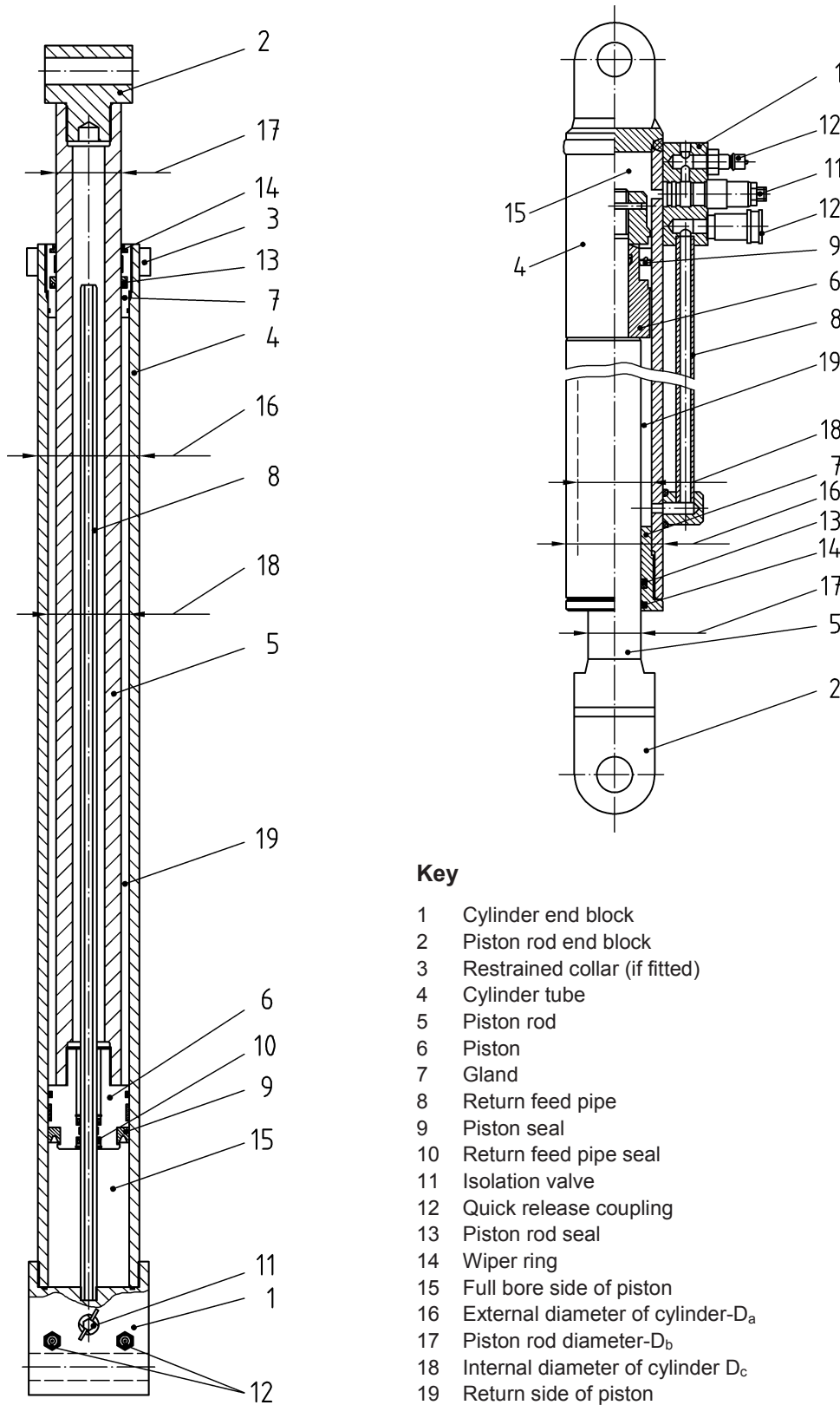


Figure 3 — Examples of double acting rams

3.2 ram components (see Figures 1, 2 and 3)

3.2.1

piston (sealed or bypass)

component that transmits the force created by the fluid pressure to the piston rod (see Figures 1 and 3)

3.2.2

piston rod

telescoping inner load bearing component that is terminated with a piston (sealed or bypass type) at one end and an end block at the other end

3.2.3

cylinder tube

outer cylinder of the ram that resists the internal pressure

3.2.4

cylinder end block

component at the end of the cylinder tube that provides a connection for attaching hydraulic fittings and isolation valves and connection points to the surrounding structure

NOTE The end block may consist of two parts with a separate block for the hydraulic fittings and valves.

3.2.5

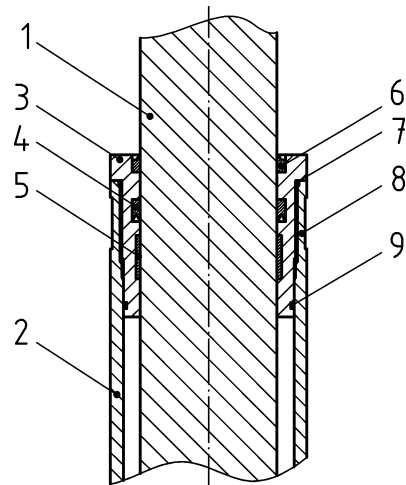
piston rod end block

component at the end of the piston rod that provides a connection point for attaching to the surrounding structure

3.2.6

gland

component that centralizes the piston rod and may incorporate seals, bearing rings and wiper rings, (see Figure 4)

**Key**

- | | | | |
|---|-----------------|---|------------------------|
| 1 | Piston rod | 6 | Wiper ring |
| 2 | Cylinder tube | 7 | 'O' ring |
| 3 | Gland | 8 | Gland retaining thread |
| 4 | Piston rod seal | 9 | 'O' ring |
| 5 | Bearing ring | | |

Figure 4 — Example of a gland

3.2.7 mounting fasteners

3.2.7.1

load bearing mounting fastener

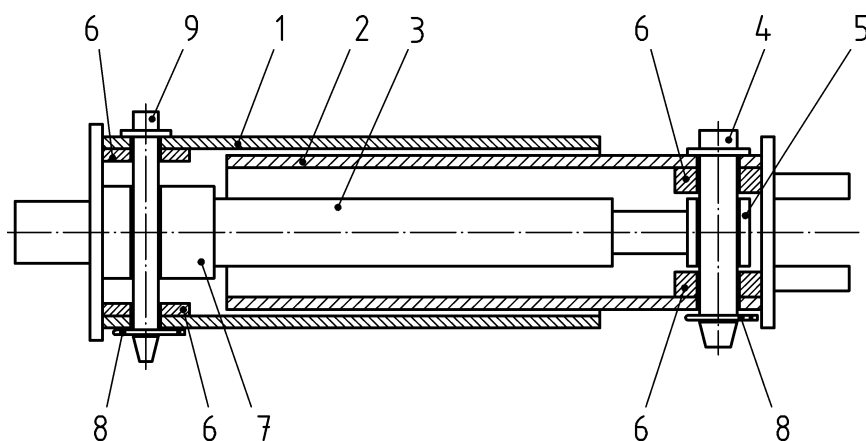
pin or bolt that transfers the full load of the ram from the piston rod end block or from the cylinder end block to the surrounding structure, (see Figure 5)

NOTE The pinhole diameter normally provides a clearance tolerance and not an interference fit for the pin.

3.2.7.2

non-load bearing mounting fastener

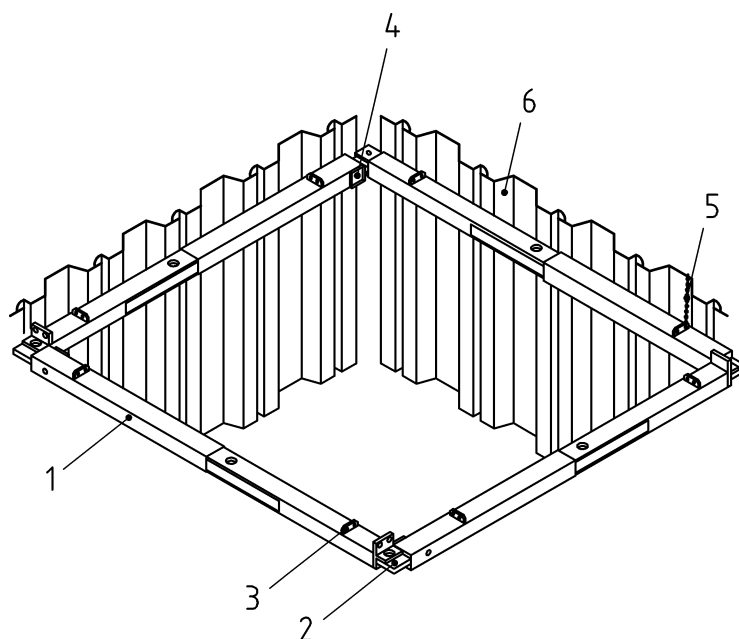
pin or bolt that retains a ram in position only (see Figure 5)



Key

- | | | | |
|---|----------------------------------|---|-------------------------------|
| 1 | Outer tube of the adjustable leg | 6 | Mounting structure |
| 2 | Inner tube of the adjustable leg | 7 | Cylinder end block |
| 3 | Ram | 8 | Retaining clips |
| 4 | Load bearing mounting block pins | 9 | Non-load bearing mounting pin |
| 5 | Piston rod end block | | |

Figure 5 — Example of mounting blocks and pins



Key

- | | | | |
|---|--------------------------------|---|-----------------------------------|
| 1 | Hydraulic bracing frame leg | 4 | Valve housing and hose connection |
| 2 | Corner detail with pin | 5 | Restraining chain |
| 3 | Handling and restraining point | 6 | Sheet piling |

Figure 6 — Example of a hydraulic bracing frame

3.3**piston stroke**

difference between the fully retracted length of the ram and the fully extended length of the ram

3.4**hydraulic bracing frame**

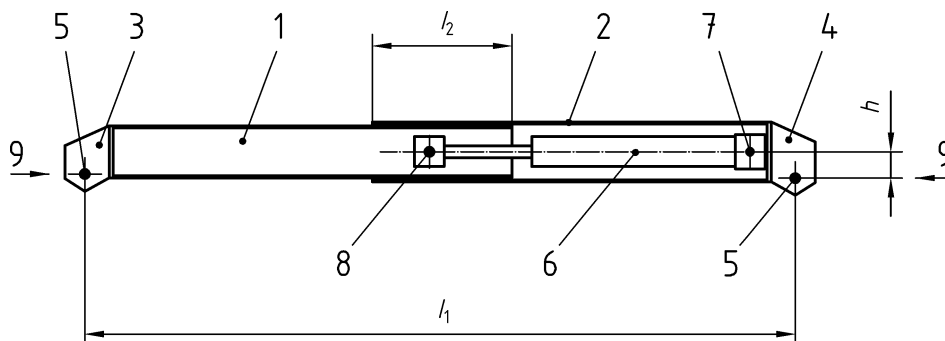
four-sided assembly that is designed to resist the applied loading on all sides (see Figure 6)

3.5**hydraulic bracing frame leg**

telescopic assembly of components, whose length is adjusted by a hydraulic ram (see Figure 7)

NOTE 1 Each end of the leg has a pin connection. The leg may be capable of extension with an extension bar using a suitable connection (see Figure 8). The leg can also have a telescopic mechanical adjustment. Two strength classifications of frame legs are available Class A and Class B

NOTE 2 Class B hydraulic bracing frame legs are limited to a length of 20,0 m for the purposes of this document.

**Key**

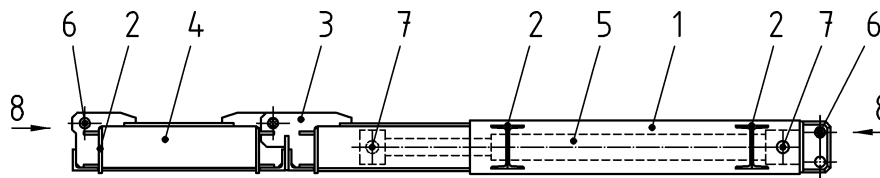
- | | |
|----------------------------|---------------------------|
| 1 Inner adjustable tube | 6 Ram |
| 2 Outer adjustable tube | 7 Cylinder end block pin |
| 3 Female corner connection | 8 Piston rod mounting pin |
| 4 Male corner connection | 9 Axial load F_K |
| 5 Corner pin | |

l_1 Maximum pin to pin leg dimension

l_2 Minimum overlap of the outer tube to the inner tube

h Eccentricity of F_K related to the centre line of the leg

Figure 7 — Example of a hydraulic bracing leg without extension bars



Key

- | | | | |
|---|--|---|------------------|
| 1 | Hydraulic bracing frame leg | 5 | Ram |
| 2 | Handling and restraining points | 6 | Corner pin |
| 3 | Bolted and pinned joint to the extension bar | 7 | Mounting pin |
| 4 | Extension bar | 8 | Axial load F_K |

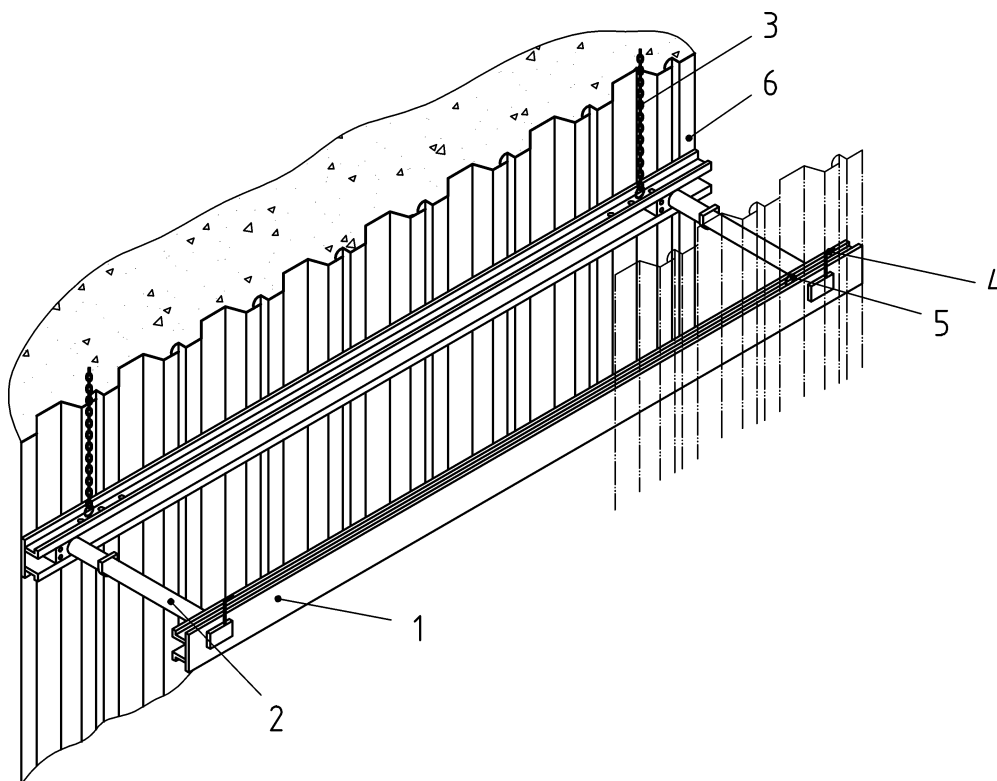
Figure 8 — Example of a hydraulic bracing frame leg with an extension bar

3.6

waler frame

frame comprising two waler rails held apart by at least two hydraulic struts

NOTE The frame in normal use is used horizontally (see Figure 9).



Key

- | | | | |
|---|-----------------------|---|--------------------------------|
| 1 | Waler rail | 4 | Pin |
| 2 | Hydraulic waler strut | 5 | Handling and restraining point |
| 3 | Restraining chain | 6 | Sheet piling |

Figure 9 — Example of a waler frame

3.7**waler rail**

fixed length structural component used horizontally usually to support piling sheets

NOTE Two strength classifications of waler rail are available Class A and Class B.

3.8**hydraulic waler strut**

hydraulic strut that may be lengthened by the addition of extension bars and that is used in conjunction with waler rails

NOTE These components resist compressive forces only (see Figure 10).

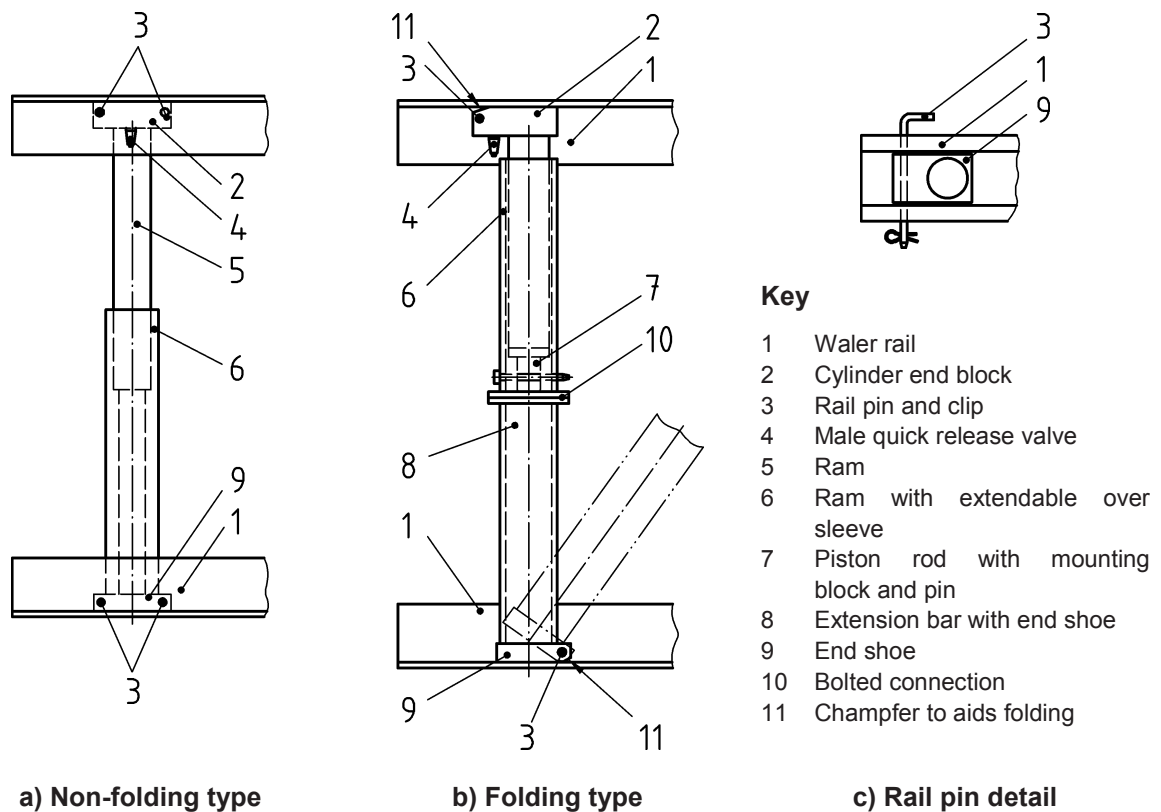


Figure 10 — Examples of waler struts

3.9**full-bore side of the piston**

side of the piston to which the active hydraulic pressure is applied

3.10**return side of the piston**

opposite side of the piston to the full bore side of a double acting ram

3.11 valves

3.11.1

quick release valve coupler (QR)

pair of components, of which one end is male and one end female, that provide hydraulic connections between rams and hoses

NOTE 1 These couplers are also known as quick-action couplers.

NOTE 2 Both ends of the coupler are self-sealing when disconnected.

NOTE 3 Hydraulic fluid is introduced into a ram through these connections with the convention that the male end is used to introduce fluid to the extend side of the ram. On double acting rams a female end is provided to the retract side.

3.11.2

isolation valve (IV)

mechanical operated valve or hydraulic valve positioned on the full bore side of a ram which provides additional hydraulic isolation and enables a quick release coupler to be reconnected when the ram is under load

3.11.3

quick release coupler safety valve (SV)

automatic valve that only operates when there is mechanical damage to a quick release coupler

NOTE The purpose of the valve is to prevent a loss of pressure in the ram following accidental damage to a quick release coupler.

3.11.4

pressure relief valve (PRV)

device, usually proprietary, fitted to protect against unintentional over-pressurization of a ram

3.11.5

pilot operated check valve (POCV)

device, usually proprietary, that ensures that a double acting ram cannot retract unless hydraulic pressure is applied to the retract side of the piston

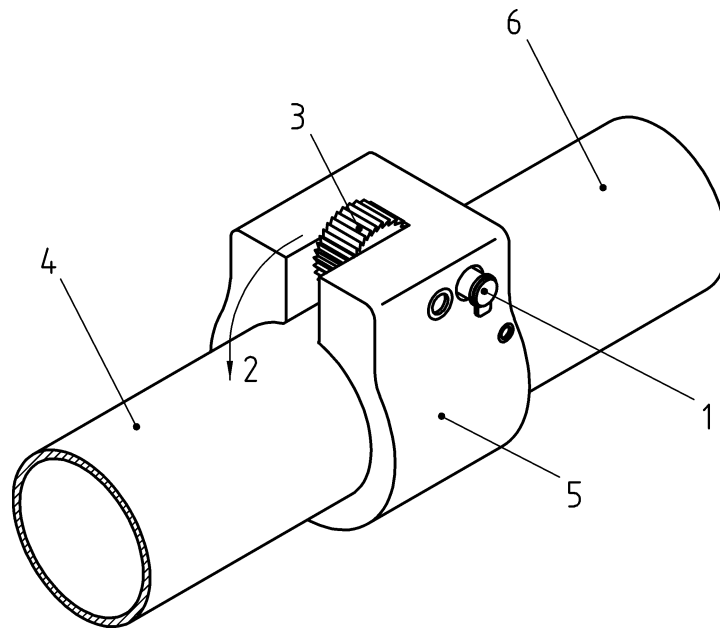
3.12

mechanical locking systems for waler struts

3.12.1

mechanically locking clamp (MLC)

mechanical device activated automatically or pre-set manually that prevents the ram from closing down when there is a loss of hydraulic pressure (see Figure 11)



Key

- 1 Manually operated pin to activate locking teeth
- 2 Direction of the locking cam
- 3 Spring operated toothed cam (rotates and locks against the ram outer cylinder)
The cam is shown in the open position.
- 4 Ram outer cylinder tube
- 5 Locking clamp mounted between the over-sleeve and the ram outer cylinder
- 6 Ram over-sleeve

Figure 11 — Example of a mechanical clamp system for a waler strut

3.12.2 mechanically locking telescoping over-sleeve (MLOS)

telescoping component that totally encloses a ram strut (see Figure 2)

NOTE A series of pinholes are provided so that a locking pin can be positioned to prevent the strut from collapsing fully in the event of a loss of hydraulic pressure.

3.13 extension bars

3.13.1 waler strut extension bar

component for in line insertion in a waler strut to increase its length (see Figure 12)

NOTE Three basic types are available:

- a) with flanged connectors at each end;
- b) with a pinned over-sleeve extension bar where there may be a variety of lengths;
- c) with a pinned spigot and socket connection.