



## Dorman Long Technology

### Strand jack systems

Strand jacks, power packs and control systems



## Introduction

Strand jacks offer an economic, compact and highly controllable method for carrying out heavy lifting and skidding operations. This is particularly true when heavy loads need to be moved through long distances or have a large number of lifting points. We offer complete systems, comprising strand jacks, power packs and control systems together with on site supervision and training and offsite engineering.

For our range of strand jacks from 15 tonnes to 1672 tonnes please see pages 3 to 18.

For our range of hydraulic power packs please see pages 19 and 21.

For our range of control systems please see pages 22 to 27

We have been designing, manufacturing and using hydraulic strand jack systems since 1992 for use in the construction of bridges, refineries, offshore structures, large roof structures, power stations and other projects where these systems can be used to best advantage. The heavy lifting and skidding operations performed using this equipment are usually critical to the success of a project and it is therefore essential that the equipment is robust, reliable and easily serviced. All our jacking systems are 100% designed and developed in-house to international standards and designed and manufactured in accordance with our accredited ISO 9001 quality management systems. Our systems are designed for safety, long life, robust performance and ease of maintenance. To date we have manufactured over 600 strand jacks for clients all over the world, with a combined lifting capacity of over 120,000 tonnes.

All our systems are supplied with a comprehensive manual for the operation and maintenance of the equipment, including a full set of test certificates and a section giving guidance on method statements, risk assessment and health & safety with examples from our own heavy lifting projects. We offer on-site support, advice and training given by our own heavy lifting Site Supervisors to ensure that the equipment is used safely and properly maintained. We are also able to offer expert in-house engineering advice to our clients on how to use the equipment to best advantage, including detailed design of temporary works.

All our jacks and power packs can be monitored and controlled by a single operator using either our DL-M manual control system or our DL-P40 computer controlled system.



2 No DL-S836 strand jacks during 125% load testing in the factory, with transport frames

## Strand Jacks.

Our standard strand jacks range from the single strand DL-S15 through to the 66 strand DL-S1022 as summarised below, and are all designed to be suitable for use with both 18 mm 7-wire drawn strand or 15.7 mm 7-wire super strand to BS 5896/3-1980. General arrangement drawings of these strand jacks and fixed anchors are given on the following pages. The following table summarises our range :

|                                                             | DL-S015 | DL-S046 | DL-S062 | DL-S108 | DL-S185 | DL-S294 | DL-S418 | DL-S588 | DL-S697 | DL-S836 | DL-S1022 |
|-------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Safe working load, tonnes (18 mm 1700 N/mm <sup>2</sup> )   | 15      | 46      | 62      | 108     | 185     | 294     | 418     | 588     | 697     | 836     | 1022     |
| Safe working load, tonnes (15.7 mm 1860 N/mm <sup>2</sup> ) | 11.4    | 34      | 45      | 79      | 136     | 216     | 307     | 432     | 512     | 614     | 750      |
| Safe working load, tonnes (15.7 mm 1770 N/mm <sup>2</sup> ) | 10.8    | 32      | 43      | 75      | 129     | 205     | 291     | 410     | 486     | 583     | 713      |
| Number of strands                                           | 1       | 3       | 4       | 7       | 12      | 19      | 27      | 38      | 45      | 54      | 66       |

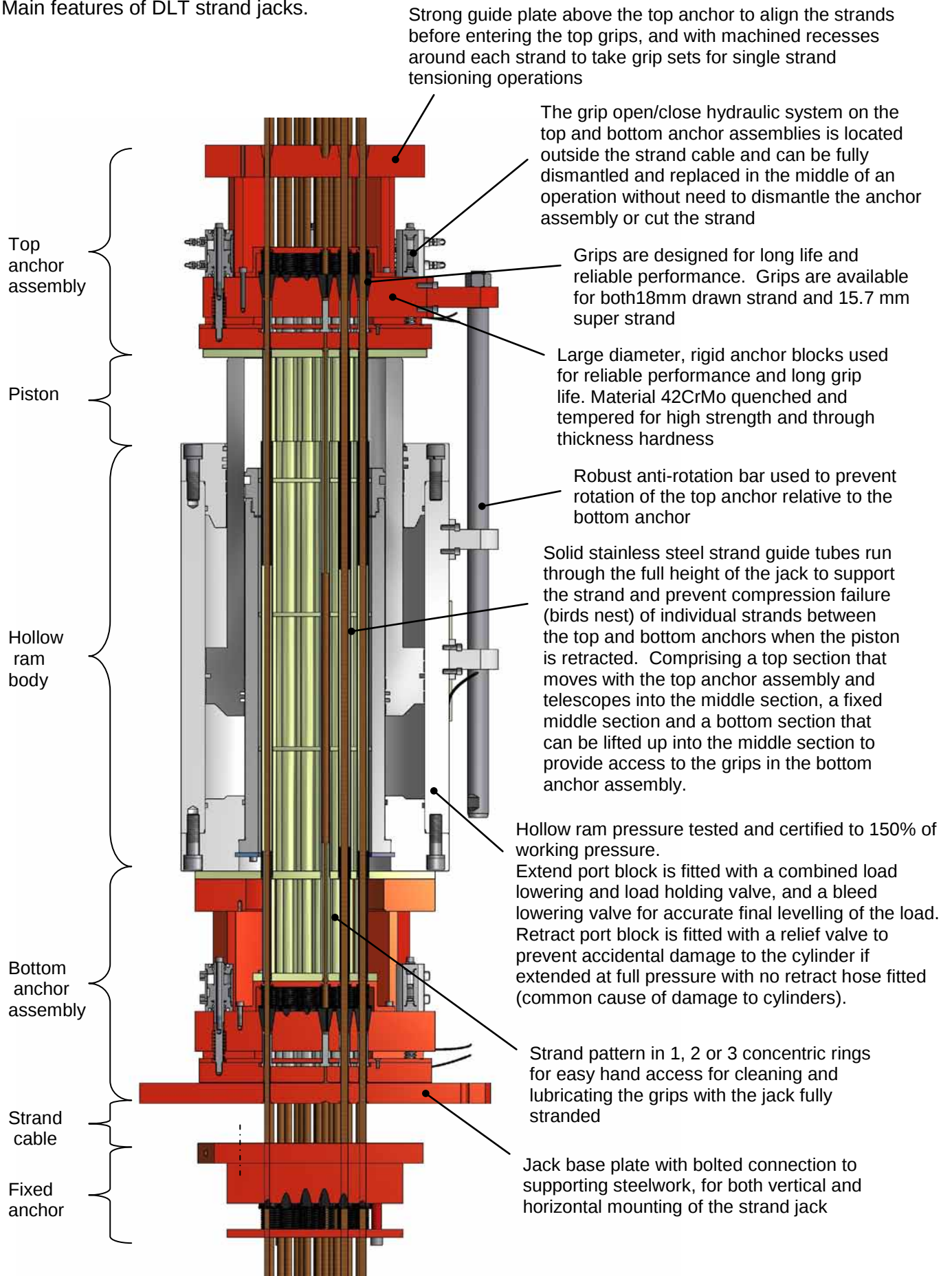
The safe working loads given above are for 18mm and 15.7mm 7-wire strand complying to BS 5896/3-1980. Please note that different grip sets must be used for each size of strand.

The main features of all our strand jacks are as follows, and illustrated on the next page:

- Safe working load of the jacks has been set at 40% of the minimum breaking load of the strand. (i.e. factor of safety = 2.5)
- Designed for use with both 18mm and 15.7mm diameter strands.
- Telescopic strand guide tubes through the full height of the strand jack to prevent buckling and 'birds nesting' of the strands inside of the jack. Made from solid stainless steel for long life.
- Strand patterns used and the arrangement of top and bottom anchors have been designed for ease of access to service the grips. All grips can be fully serviced in the middle of a lift with the jack fully stranded.
- Main cylinder pressure tested and certified to 150% of working pressure
- Complete strand jack load tested and certified to 125% of safe working load
- Double acting mini-jacks used for opening/closing the grips in the top and bottom anchors, which can be fully replaced in the middle of a lift if necessary without dismantling the strand anchors or cutting the strand.
- Pilot operated over centre valve fitted to the extension port block for controlled and synchronised load lowering.
- Load holding valve fitted to the extension port block for safe holding of the load in the event of a hose burst.
- Pressure compensated bleed valve fitted to the extension port block for very slow final lowering for precise alignment of the load and smooth transfer of load to supports.
- During a lifting operation the strand jack can be fully dismantled for repair with the load held in the bottom anchor
- Fitted with quick release hose couplings
- Corrosion protection to all exposed and running surfaces for long life and suitable for use in a marine environment
- Single strand tensioning plate fitted to the top of the jack.

Project specific steel fabrications are required to support the strand jack and to connect to the fixed anchor to the lifted load. Please see the project photographs on our web site for many examples of the options available. We are able to offer a full design and supply service for these items.

## Main features of DLT strand jacks.



The strand is delivered to order in coils of up to 3.2 tonnes (1730m) and is placed in a strand dispenser on site for pulling and cutting to length as shown below:



For ease of handling and cleanliness of the strand we recommend that wherever possible the jack and fixed anchor are stranded at ground level and lifted in a single jack carriage assembly as shown below. We are able to provide a full design and supply service for this type of jack carriage to suit the jack size, strand length and support conditions.



### DL-S15B strand jack

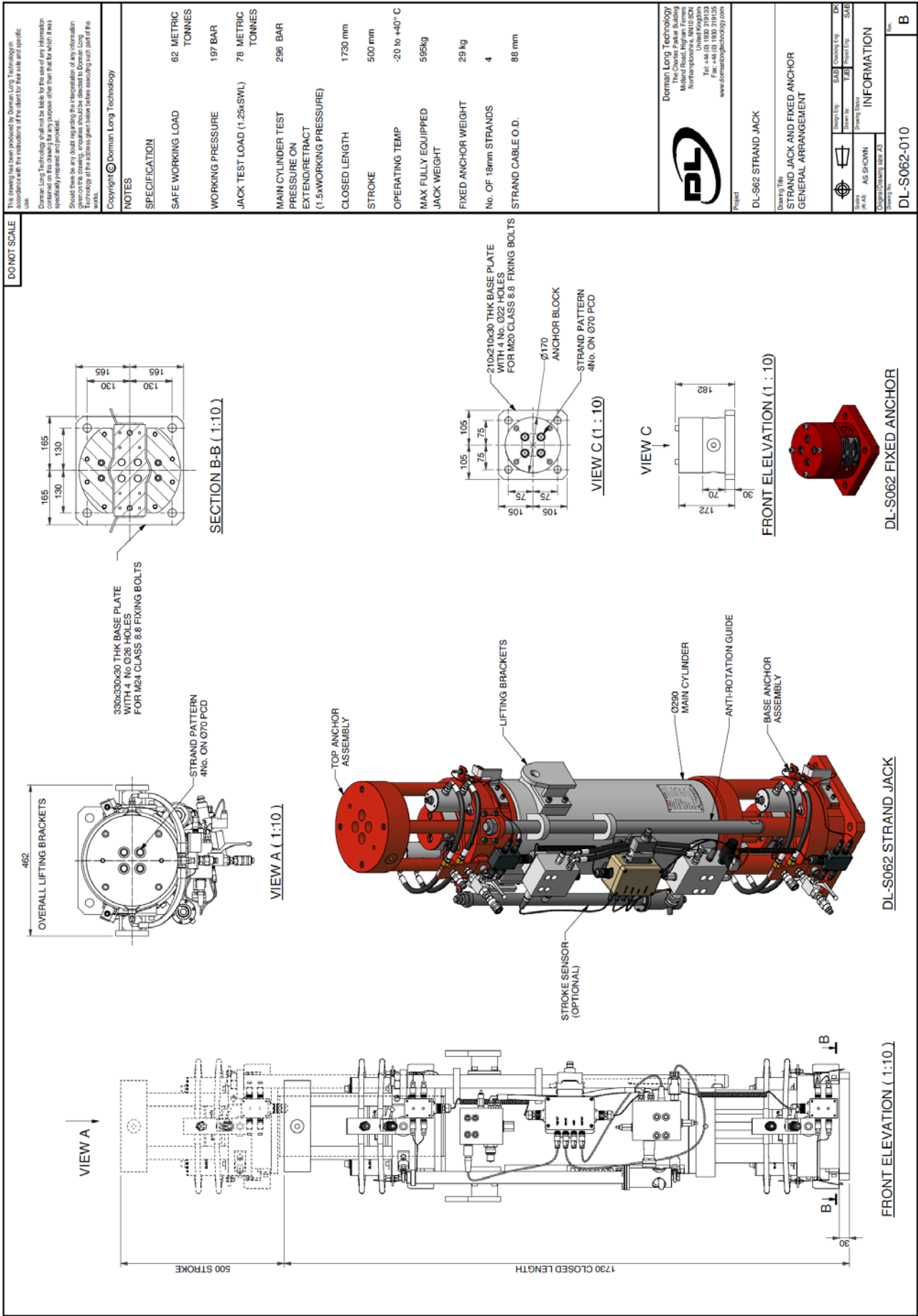
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## DL-S46 strand jack

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DL-S62 strand jack

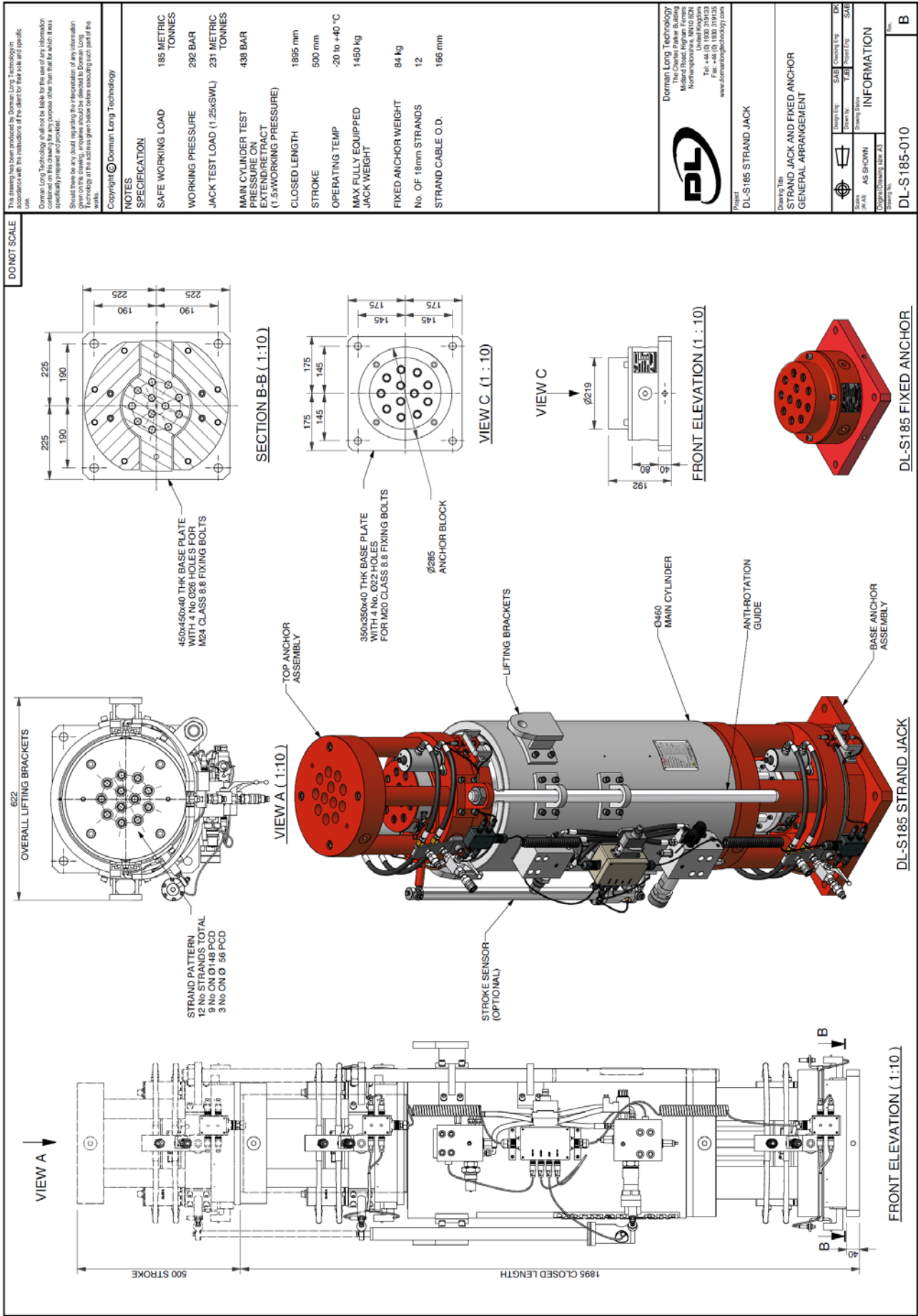


## DL-S108 strand jack

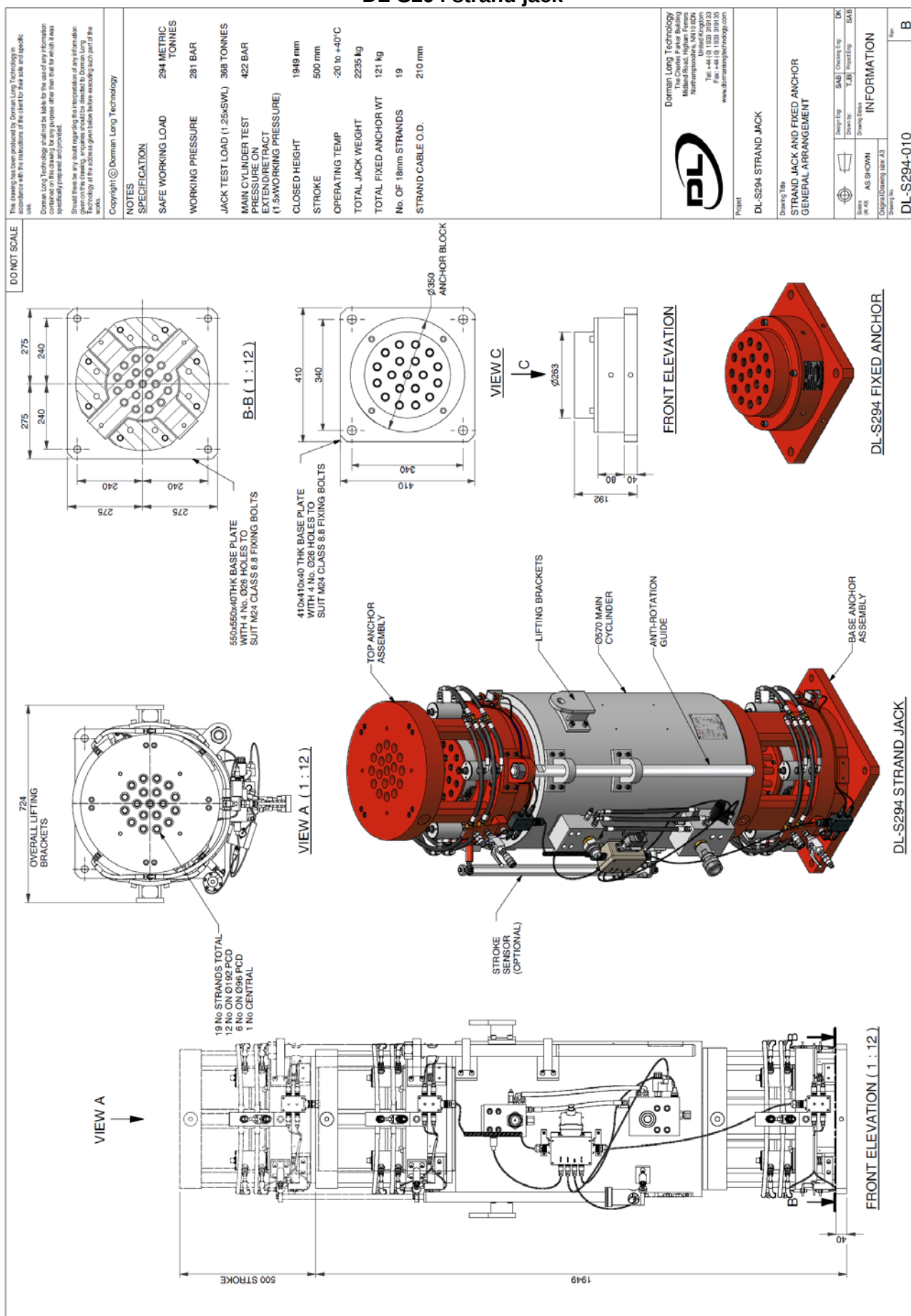
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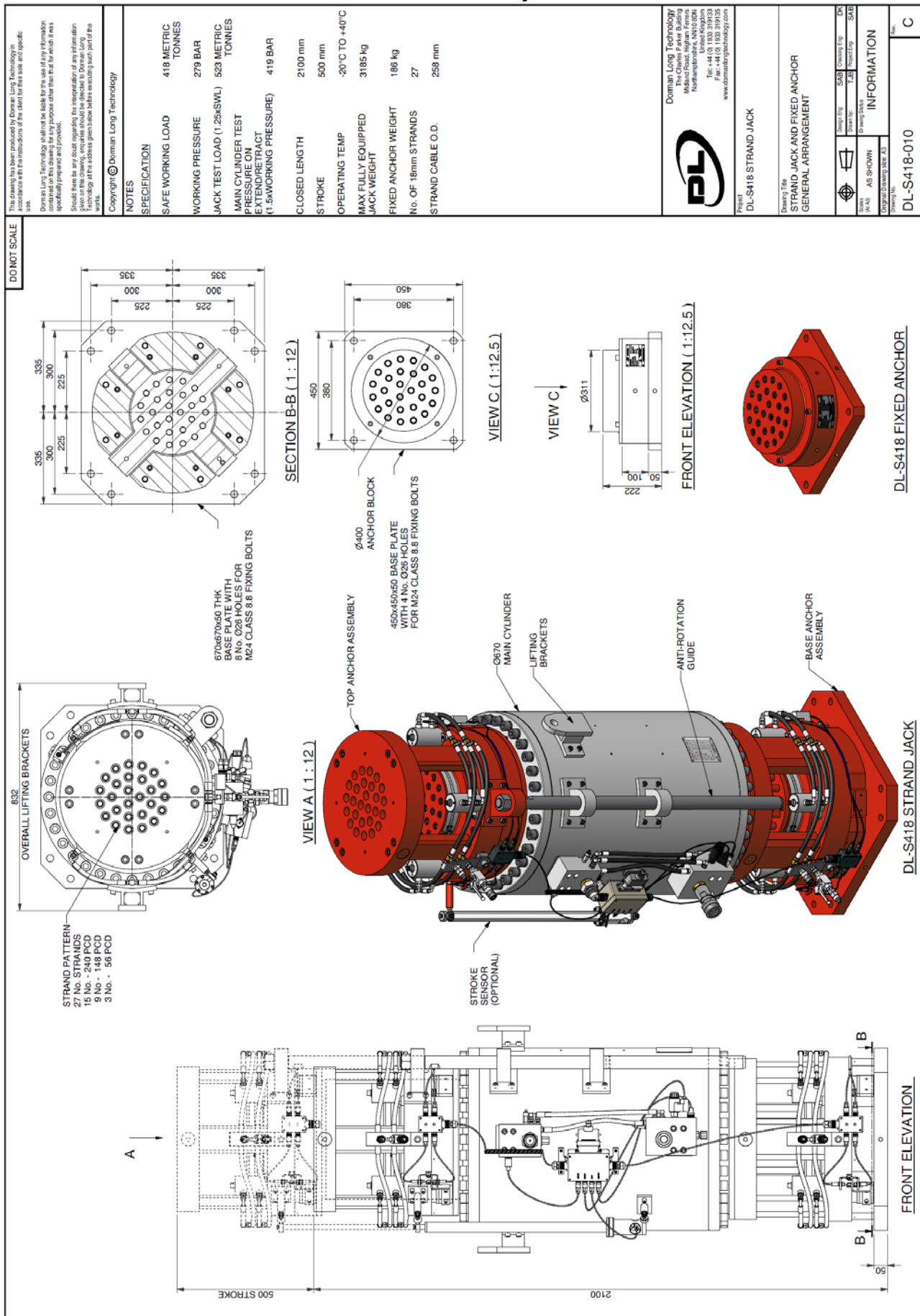
DL-S185 strand jack



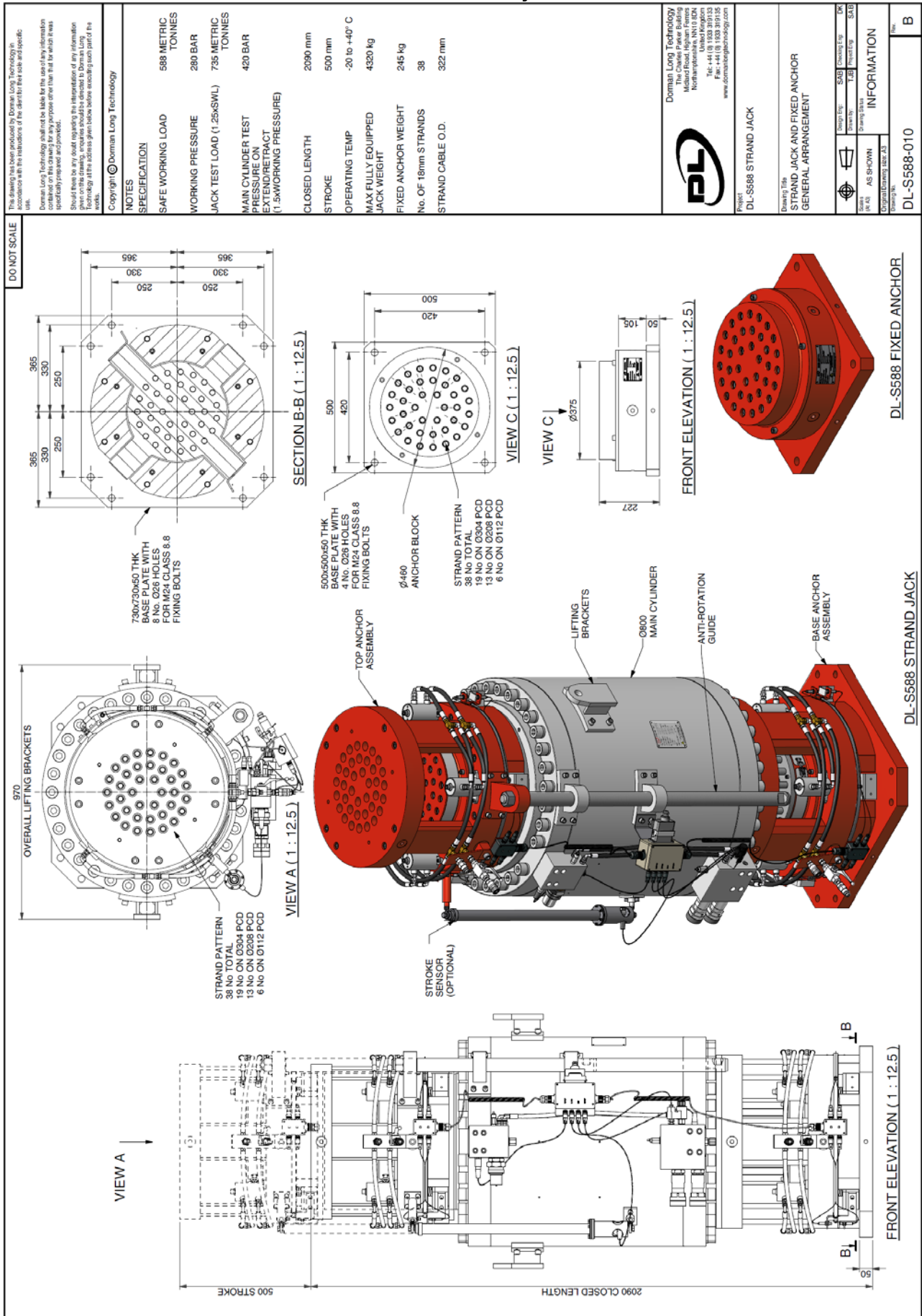
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### DL-S418 strand jack

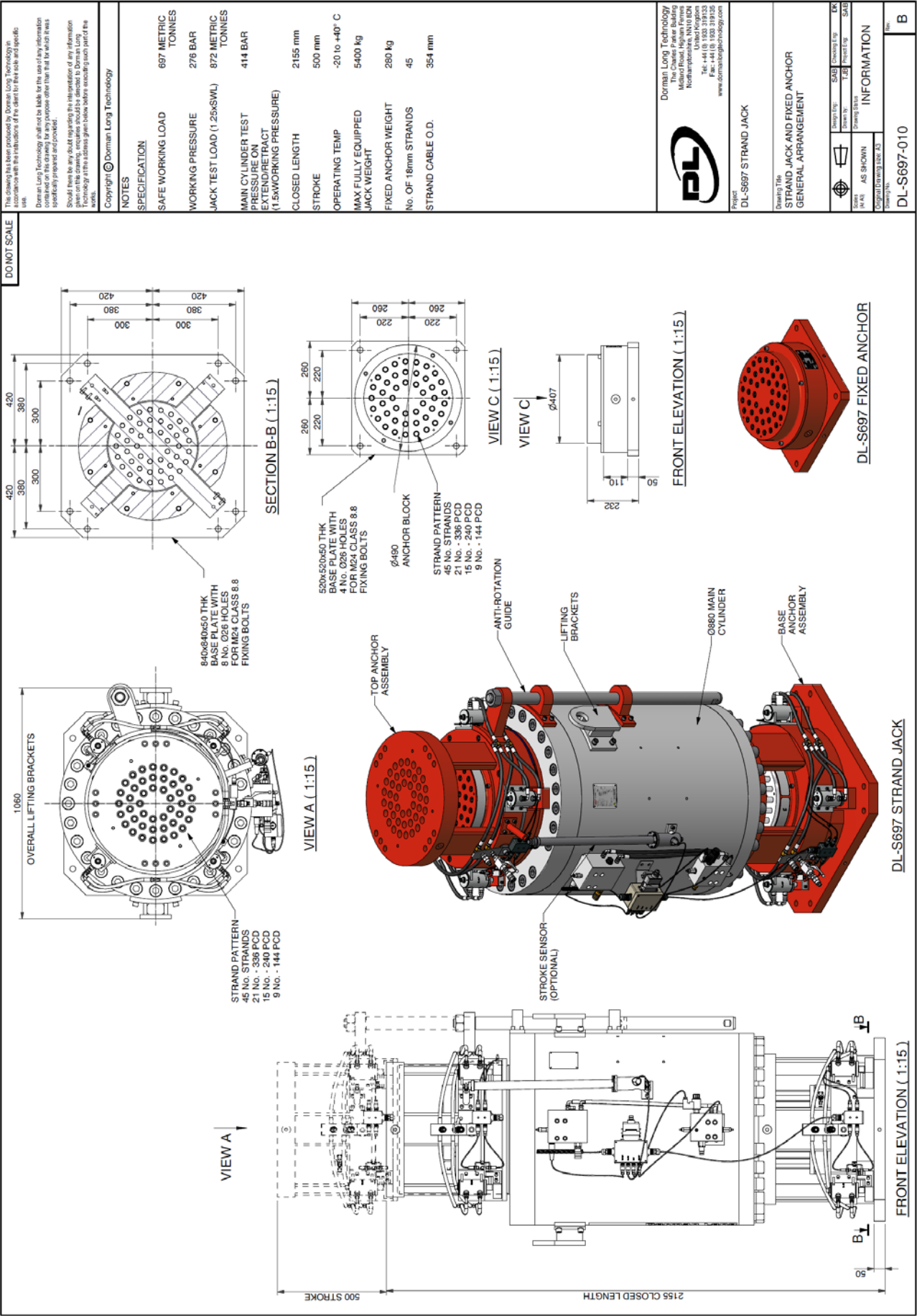


# DL-S588 strand jack





DL-S697 strand jack



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| NOTES                                                                  |                    |
|------------------------------------------------------------------------|--------------------|
| <b>SPECIFICATION</b>                                                   |                    |
| SAFE WORKING LOAD                                                      | 836 METRIC TONNES  |
| WORKING PRESSURE                                                       | 275 BAR            |
| JACK TEST LOAD (1.25xSWL)                                              | 1045 METRIC TONNES |
| MAIN CYLINDER TEST PRESSURE ON EXTEND / RETRACT (1.5xWORKING PRESSURE) | 413 BAR            |
| CLOSED LENGTH                                                          | 2180 mm            |
| STROKE                                                                 | 500 mm             |
| OPERATING TEMPERATURE                                                  | -20 to +40° C      |
| MAX FULLY EQUIPPED JACK WEIGHT                                         | 6500 kg            |
| FIXED ANCHOR WEIGHT                                                    | 345 kg             |
| No. OF 18mm STRANDS                                                    | 54                 |
| STRAND CABLE O.D.                                                      | 402 mm             |

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Project: **DL-S836 STRAND JACK**

Drawing Title: **STRAND JACK AND FIXED ANCHOR GENERAL ARRANGEMENT**

| REVISIONS |    | DRAWING INFORMATION       |             |
|-----------|----|---------------------------|-------------|
| Rev       | By | Design Eng                | Drawing Eng |
| 1         | 1  | SAID                      | SAID        |
| 1         | 1  | Drawn by                  | Checked by  |
| 1         | 1  | AS SHOWN                  | INFORMATION |
| 1         | 1  | Original Drawing, size A3 |             |

**DL-S836 STRAND JACK**

**DL-S836 FIXED ANCHOR**

**FRONT ELEVATION (1:15)**

**VIEW A (1:15)**

**VIEW B (1:15)**

**VIEW C (1:15)**

**FRONT ELEVATION (1:15)**

**SECTION B-B (1:15)**

**OVERALL LIFTING BRACKETS**

**STRAND PATTERN**  
54 No TOTAL  
24 No ON Ø384 PCD  
18 No ON Ø288 PCD  
12 No ON Ø192 PCD

**840x840x50 THK BASE PLATE WITH 8 No. Ø26 HOLES FOR M24 CLASS 8.8 FIXING BOLTS**

**550x550x50 THK BASE PLATE WITH 4 No Ø25 HOLES FOR M24 CLASS 8.8 FIXING BOLTS**

**Ø540 ANCHOR BLOCK**

**STRAND PATTERN**  
54 No TOTAL  
24 No ON Ø384 PCD  
18 No ON Ø288 PCD  
12 No ON Ø192 PCD

**TOP ANCHOR ASSEMBLY**

**STROKE SENSOR (OPTIONAL)**

**LIFTING BRACKETS**

**Ø980 MAIN CYLINDER**

**ANTI-ROTATION GUIDE**

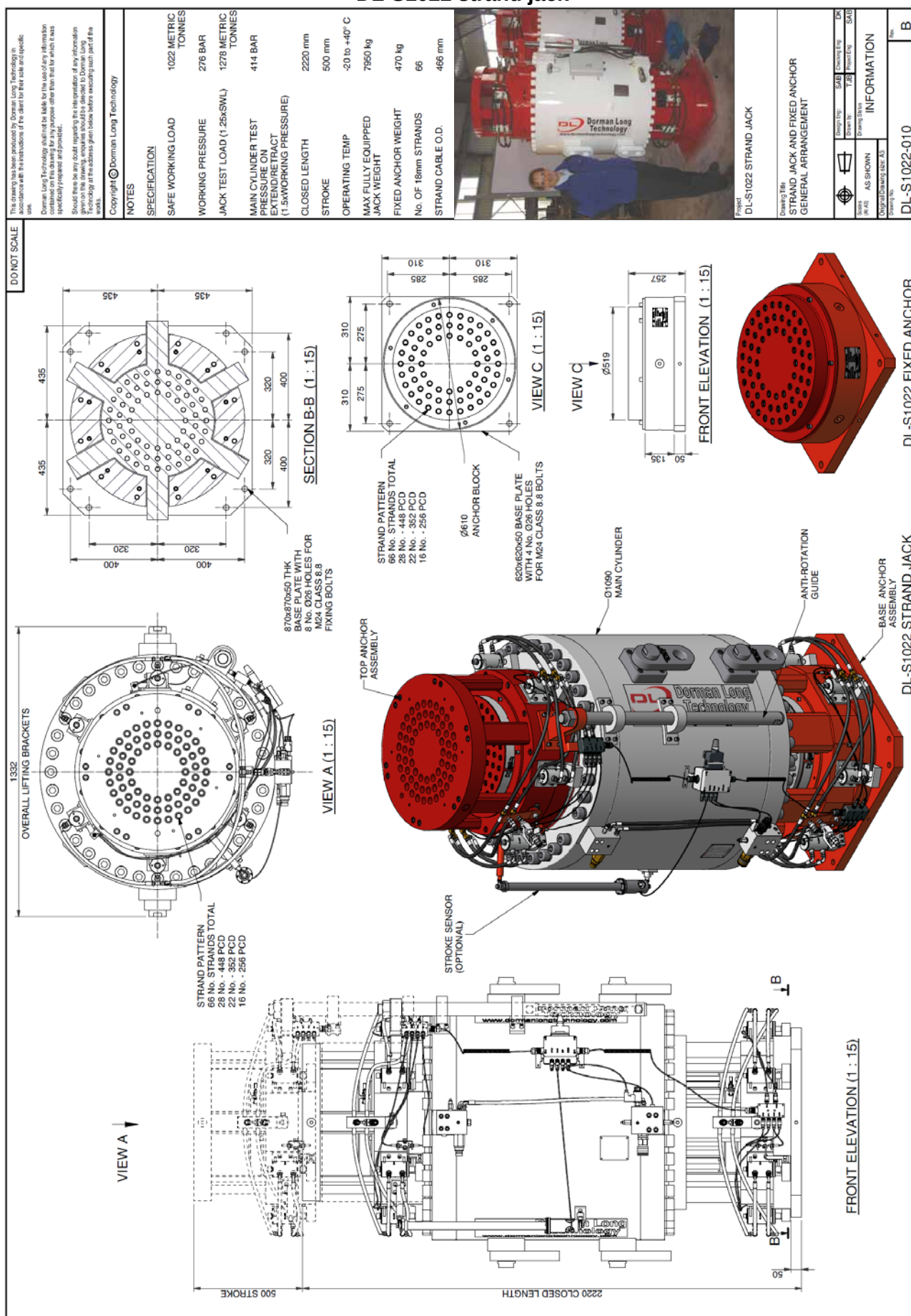
**BASE ANCHOR ASSEMBLY**

**2180 CLOSED LENGTH**

**500 STROKE**

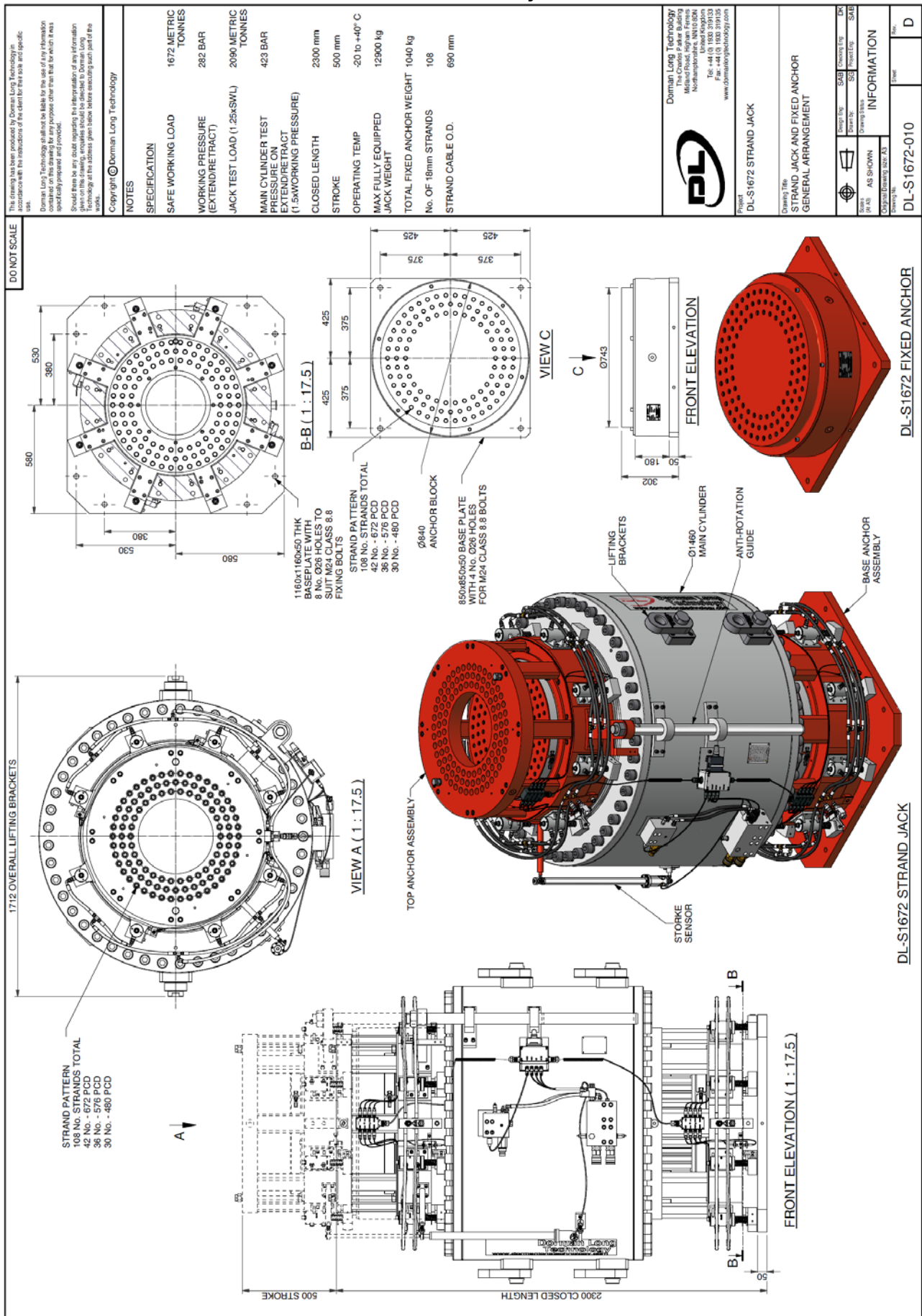
**FRONT ELEVATION (1:15)**

[www.dormanlongtechnology.com](http://www.dormanlongtechnology.com)



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## DL-S1672 strand jack



We produce a wide range of diesel and electric powered hydraulic power packs which are compatible with both our DL-M manual control system or our DL-P40 computer control system. In addition, all our power packs come with their own fixed control panel for local operation of the connected jacks. Our power packs are designed for reliability in harsh environments, ease of service and long life. A single power pack can be designed to power 1, 2, 4, 6, 8, 10 or 12 jacks.

The operating speed of the strand jacks is related to the flow of oil to the main cylinder. The approximate maximum movement speed of the load in metres per hour is given below for various combinations of oil flow and jack size:

| L / min | DL-S15 | DL-S46 | DL-S62 | DL-S108 | DL-S185 | DL-S294 | DL-S418 | DL-S588 | DL-S697 | DL-S836 | DL-S1022 |
|---------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|----------|
| 3       | 14.7   | 3.6    | 3.6    | 2.9     | 1.8     | 1.1     | 0.8     | 0.5     | 0.5     | 0.4     | 0.3      |
| 6       | 28.0   | 7.1    | 7.1    | 5.8     | 3.5     | 2.2     | 1.5     | 1.1     | 1.0     | 0.7     | 0.7      |
| 8       | 36.2   | 9.4    | 9.4    | 7.7     | 4.7     | 2.9     | 2.1     | 1.4     | 1.3     | 1.0     | 0.9      |
| 10      | 43.8   | 11.6   | 11.6   | 9.6     | 5.8     | 3.6     | 2.6     | 1.8     | 1.6     | 1.2     | 1.1      |
| 15      | 61.0   | 17.1   | 17.1   | 14.1    | 8.6     | 5.3     | 3.8     | 2.7     | 2.4     | 1.8     | 1.7      |
| 20      |        | 22.3   | 22.3   | 18.5    | 11.4    | 7.0     | 5.1     | 3.6     | 3.2     | 2.4     | 2.2      |
| 30      |        | 32.2   | 32.2   | 26.9    | 16.8    | 10.4    | 7.6     | 5.3     | 4.7     | 3.6     | 3.3      |
| 40      |        | 41.4   | 41.4   | 34.8    | 21.9    | 13.8    | 10.0    | 7.1     | 6.3     | 4.8     | 4.4      |
| 50      |        | 49.9   | 49.9   | 42.2    | 26.9    | 17.0    | 12.4    | 8.8     | 7.8     | 5.9     | 5.5      |
| 60      |        | 57.8   | 57.8   | 49.2    | 31.7    | 20.1    | 14.7    | 10.5    | 9.3     | 7.1     | 6.6      |
| 70      |        |        |        | 55.7    | 36.3    | 23.2    | 17.0    | 12.1    | 10.8    | 8.2     | 7.7      |
| 80      |        |        |        | 62.0    | 40.7    | 26.2    | 19.3    | 13.8    | 12.3    | 9.4     | 8.7      |
| 90      |        |        |        |         | 45.0    | 29.2    | 21.5    | 15.4    | 13.7    | 10.5    | 9.8      |
| 100     |        |        |        |         | 49.1    | 32.0    | 23.7    | 17.0    | 15.2    | 11.6    | 10.8     |
| 120     |        |        |        |         | 56.9    | 37.6    | 28.0    | 20.2    | 18.0    | 13.8    | 12.9     |
| 140     |        |        |        |         | 64.3    | 42.9    | 32.1    | 23.2    | 20.8    | 16.0    | 14.9     |
| 160     |        |        |        |         |         | 48.0    | 36.1    | 26.2    | 23.5    | 18.1    | 16.9     |
| 180     |        |        |        |         |         | 52.9    | 40.0    | 29.2    | 26.2    | 20.2    | 18.9     |
| 200     |        |        |        |         |         | 57.5    | 43.8    | 32.1    | 28.8    | 22.3    | 20.8     |
| 220     |        |        |        |         |         | 62.0    | 47.4    | 34.9    | 31.4    | 24.3    | 22.7     |
| 240     |        |        |        |         |         |         | 50.9    | 37.6    | 33.9    | 26.3    | 24.6     |
| 260     |        |        |        |         |         |         | 54.3    | 40.3    | 36.3    | 28.3    | 26.5     |
| 280     |        |        |        |         |         |         | 57.7    | 42.9    | 38.7    | 30.2    | 28.3     |

For example a 30 l/min flow to a DL-S185 strand jack would have an approximate operating speed of 16.8 m/hour. i.e. it would take about 2 hours to lift a distance of 33.6 metres.

Our power packs are labelled as follows:

**DL-L**(flow rate per outlet) / (number of outlets) / (working pressure) / (power type)  
Litres/min + V if variable flow Bar E or D

For example a DL-L15/2/300/E power pack is electrically driven and can operate 2 jacks with an oil flow to each jack of 15 litres/min @ 300 bar max continuous running pressure.

A DL-L60V/1/250/D power pack is diesel powered and can operate a single jack with a variable oil flow of up to 60 litres/min @ 250 bar max continuous running pressure.



The main features of our standard power packs are as follows:

- Pressure tested and certified to 125% of working pressure
- High quality piston pumps used for jack extend/retract circuit for maximum reliability and minimum variation in flow with changing jack loads.
- The secondary hydraulic circuit for opening and closing of the jack grips is designed to allow the grips to close under the action of the grip springs in the event that there is a loss of hydraulic oil pressure due to component failure or power failure. This is an important safety feature.
- All electrical components weatherproof to IP 55 or better
- Suitable for use with both mineral or biodegradable hydraulic oils
- Visual oil level & temperature indicator and automatic shut down system in the event of low oil level
- Pressure gauges to main extend/retract p-line and mini-jack p-line.
- Separate pressure relief valves for cylinder extend, cylinder retract and mini-jack open/close.
- All our power packs come with a fixed control panel for manual operation of the connected jacks during set up, and a local/remote switch for selecting between this control panel and the DL-P40 and DL-M central control systems.
- All our power packs are compatible with both our DL-M and DL-P control systems for central monitoring and control of all jacks from a single point.
- Power pack mounted in steel crash frame with fork lift truck points and lifting eyes.
- Components arranged for easy access for inspection and servicing.
- Overall size to suit transport in standard shipping containers.
- Fitted with quick release hose couplings.
- All exposed surfaces are corrosion protected for long life and are suitable for use in a marine environment.





DL-L120/2/300/D Diesel powered hydraulic power packs and DL-S588 strand jacks



All our power packs come with a control panel for operation of the connected jacks and are pre-wired for connection to our DL-P40 computer control system and our DL-M pendant control system

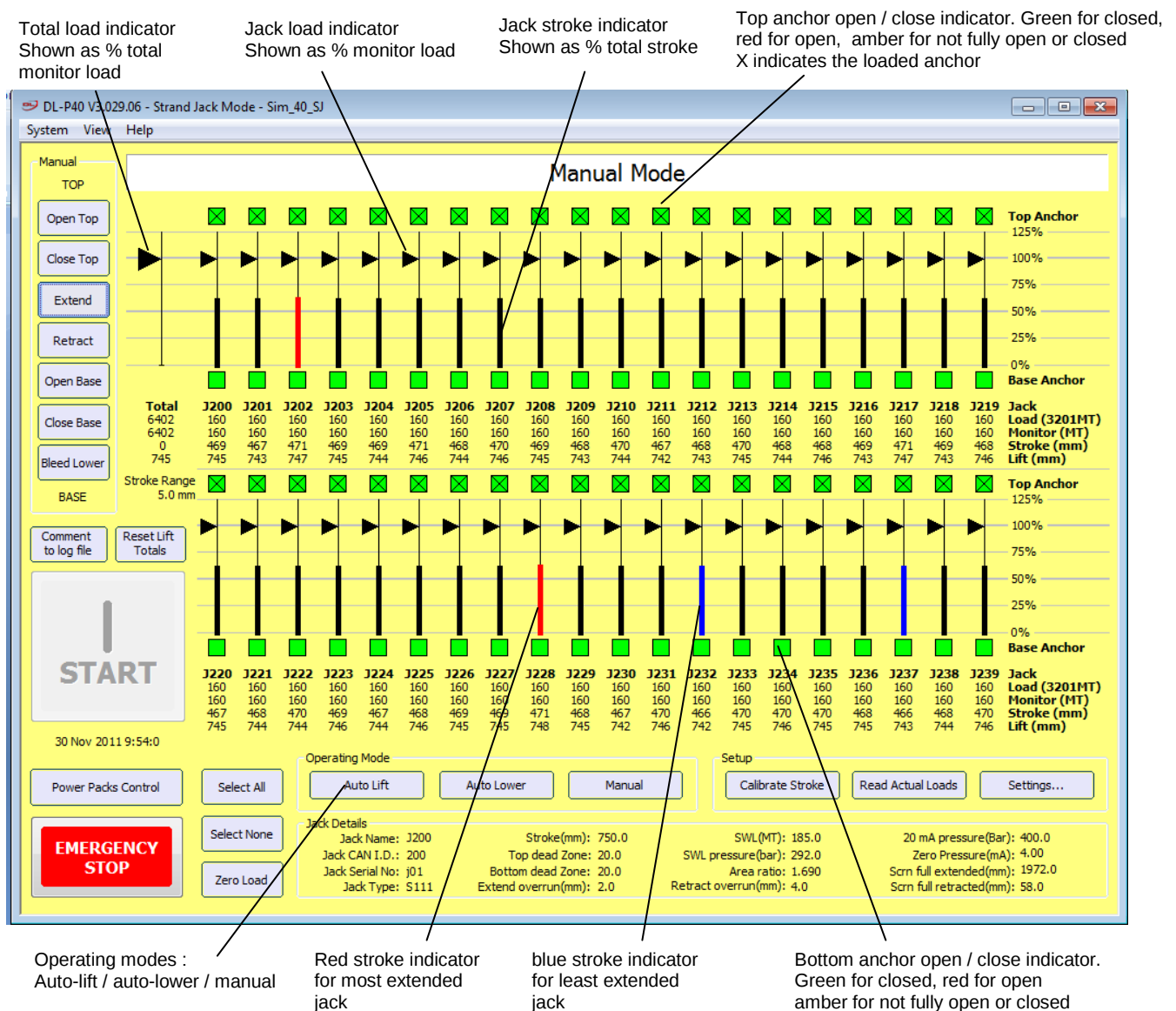


## DL-P40 computer control system

The DL-P40 computer control system is written and developed in-house by DLT using our own software and hardware engineers working in consultation with our own operators. It can be used to control all types of hydraulic jacking systems including strand jacks, climbing jacks, gripper jacks and synchronous solid ram jacking systems. The system offers the simplest possible operating screen for increased safety, and uses the latest CANbus networking system for robust communication between the control computer and CAN Controllers located in the power packs. The complete system has been tested and certified to all relevant European Electro-Magnetic Conformance (EMC) standards, an important consideration when used in a site environment.

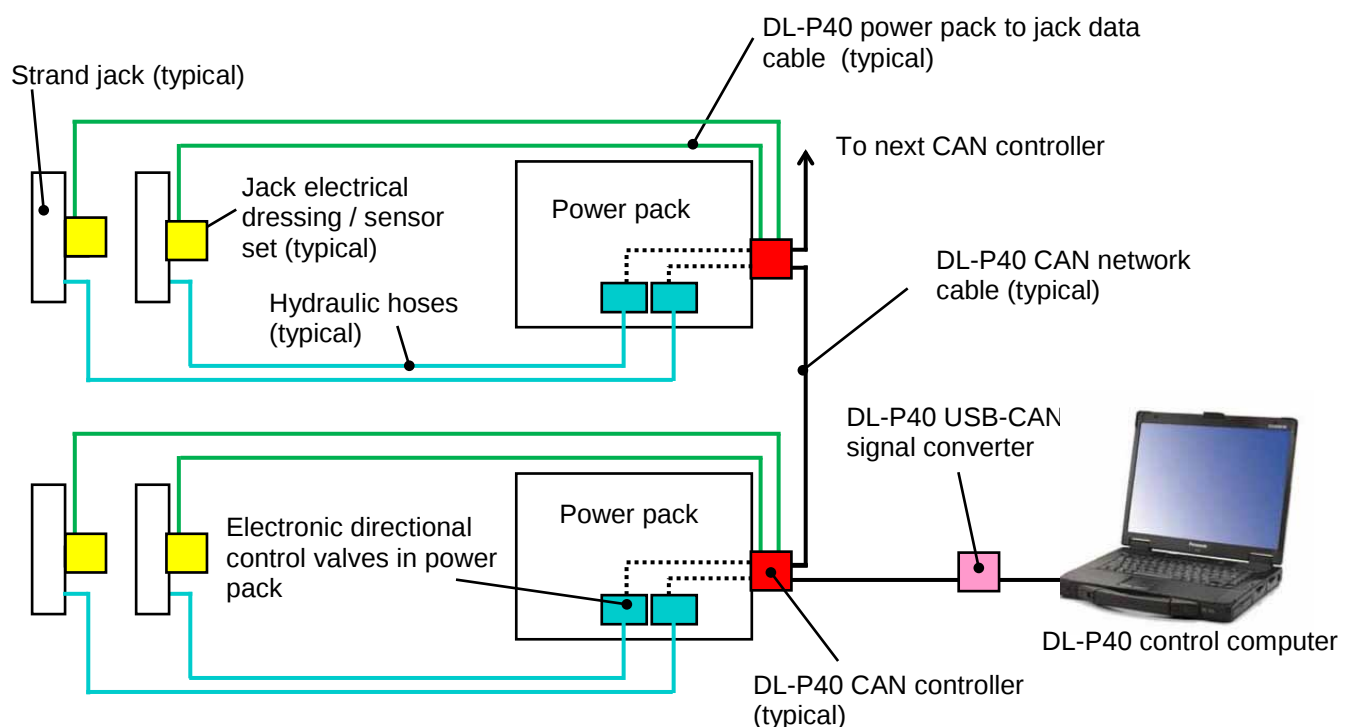
The DL-P40 uses programmable CAN Controllers located in the power packs for intelligent sensing and control functions, and a central control computer to manage all the tasks. The system can monitor and control any number of jacks, although the current interface is configured for up to 120 strand jacks. The full version of the computer software is free to load on any computer and has an inbuilt simulation mode that allows the operator to set up any combination of strand jacks and power packs and simulate a full lift taking place.

The screen that the operator will see for a 40 jack lift is as shown below. An auxiliary screen is used to show jacks from 41 to 120.



The operator can select any combination of jacks to be operated and has three operating modes – manual, auto-lift and auto-lower. In all 3 modes the computer can be set to automatically synchronise the strokes of the jacks to within a user defined range. Synchronising strokes in this way helps to maintain an even load distribution between the jacks during a lift. The operator can also set an expected load for each jack, which can be different for each jack, and can set a maximum % of this load as the overload limit for the operation. The system will automatically stop all jacks if any of the jacks reaches its overload limit. The screen displays all jack loads graphically as % of pre-set load (expected load), so if all the jacks are seeing their expected load then the operator will see all the jack load indicators on the 100% line. This method of graphically displaying the loads makes it very easy for the operator to see if a jack is not taking its expected load. After the strand jacks have lifted the load a small distance and the actual loads in each jack are shown on the screen, the operator can press the 'Set Load' button to read all these loads into the computer, and he can then ask the computer to graphically show the jack loads as a % of these Set loads instead of the expected loads.

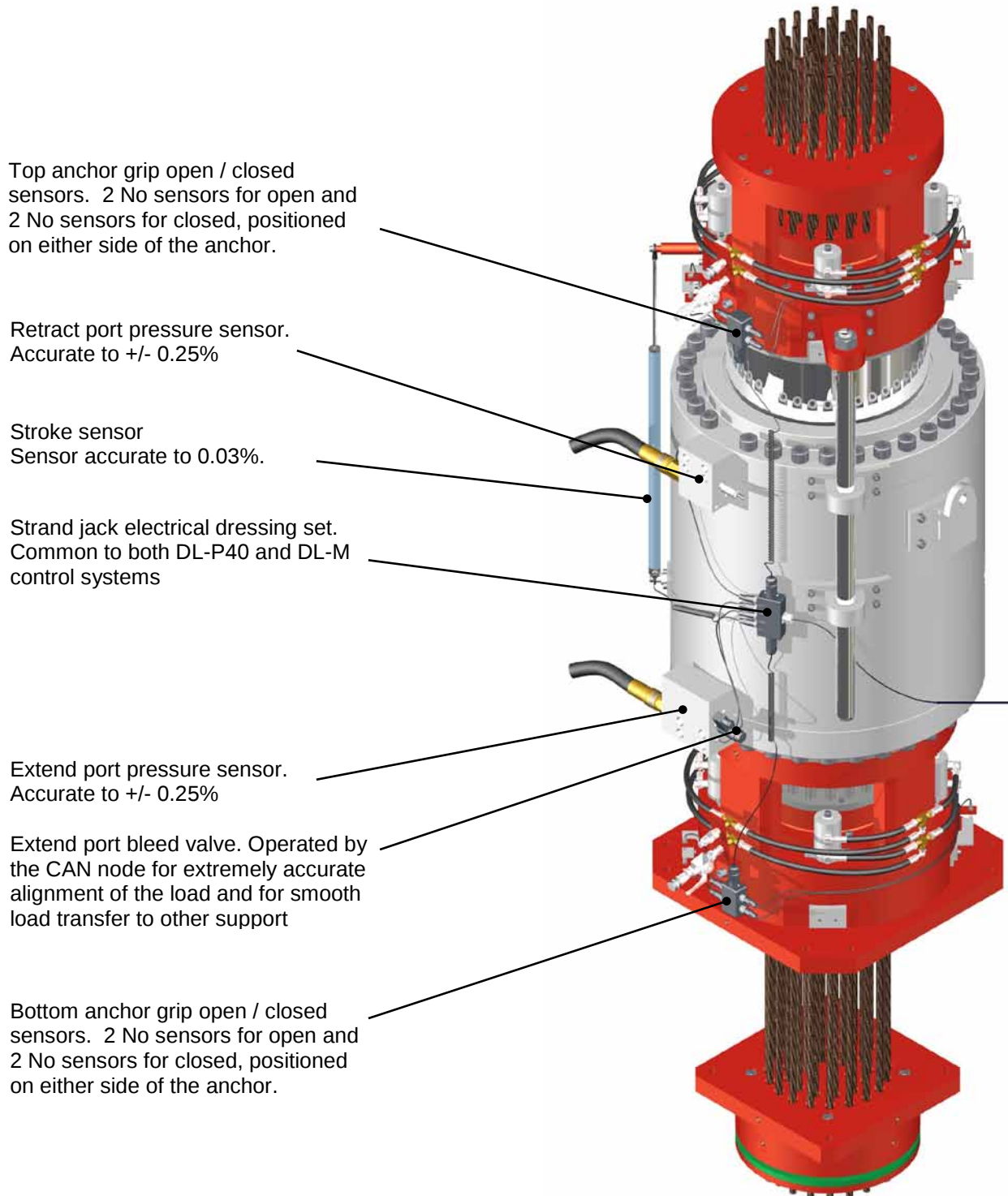
The schematic layout of the DL-P40 system hardware is as follows :



Within each power pack is a DL-P40 power pack CAN controller (shown in red above) which is connected to the DL-P40 control computer and the other power pack CAN controllers by a robust CANbus network. The DL-P40 power pack CAN controller receives all sensor data from the jacks and power pack and sends control voltages to the hydraulic valves in the power pack and the bleed valve in on the jack. The CAN controllers are programmed with the characteristics of the power packs and jacks that are connected, creating an easy to use plug-and-play system that allows the DL-P40 control computer to automatically recognise all the power packs and jacks in the system at start up. The operator can view and amend the operating parameters of the system at any time using the settings screen of the DL-P40 control software in the computer. The layout of the system and the operator defined settings can all be saved in a project file on the control computer, which can be re-loaded at any time to avoid the need to re-input this information.



Each strand jack and climbing jack has a number of sensors fitted to detect pressure, piston extension and grip open or closed states. All sensors, wiring and CAN nodes are weatherproof to IP 55 or better. The arrangement of the DL-P40 sensor system on a strand jack is shown below :



The DL-P40 computer calculates the load in the strand jack by multiplying the extend port pressure by the extend side area to get the extend side load, and then deducts the retract port pressure multiplied by the retract side area to remove inaccuracies due to any back pressure in the system on the retract side of the circuit.

In summary, the main features of the DL-P40 computer control system are as follows:

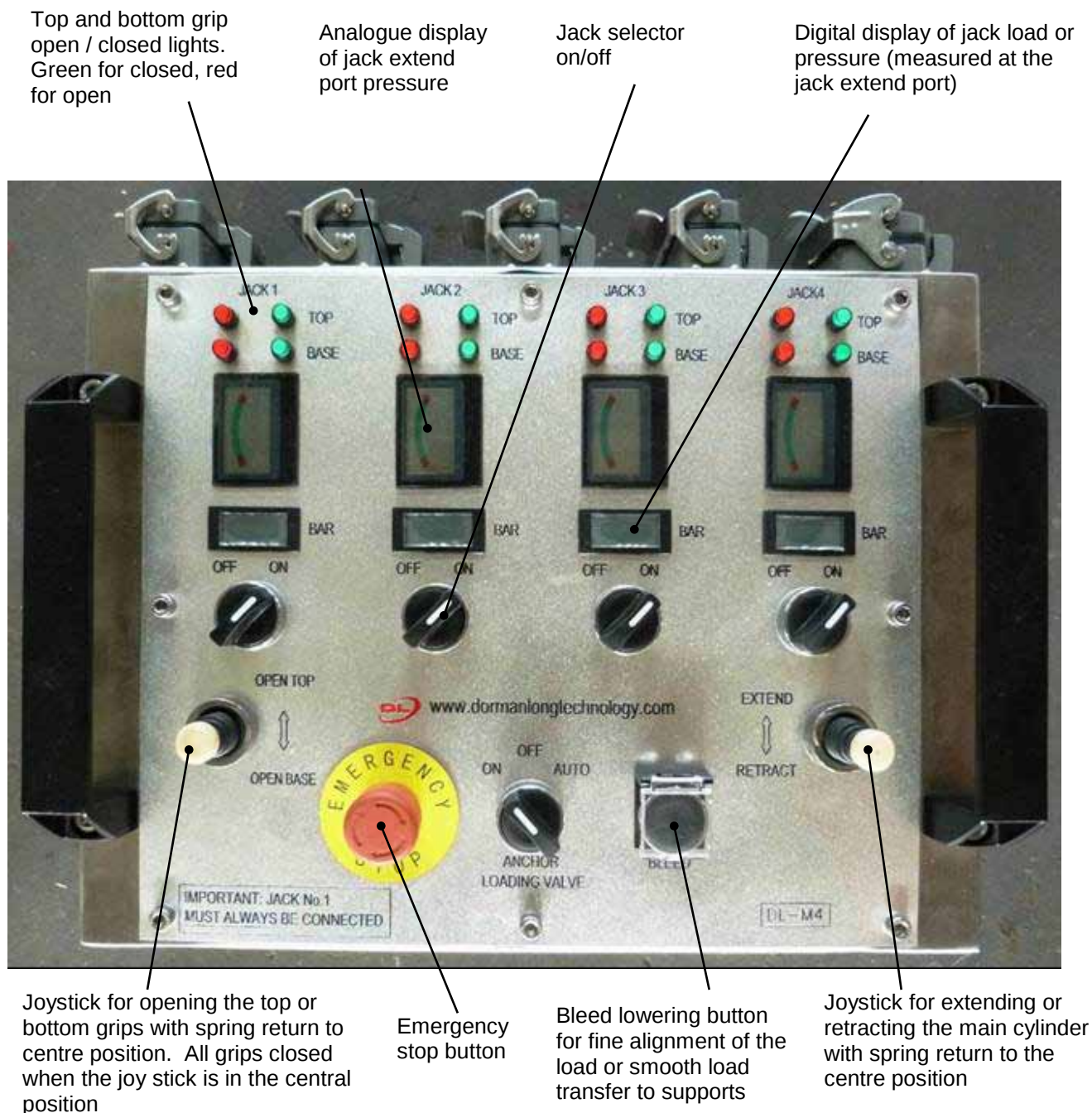
- Control of up to 120 No. jacks from a single control computer, with up to 40 jacks shown on the Main Screen and a further 80 jacks shown on the optional Jacks 41-120 Screen.
- Control any type of hydraulic ram, either with or without a gripping system fitted. Eg strand jacks, climbing jacks, gripper jacks, compression rams, tension rams.
- Control all types of hydraulic power packs, using electric motors or diesel engines, and having fixed flow or variable flow.
- CAN network for reliable communication between the control computer and the power packs and the jacks.
- Plug and play system using intelligent CAN nodes on all the power packs. The Control Computer will automatically detect and understand all the equipment being used. This greatly reduces set up time.
- User friendly interface, designed in consultation with our own operators to give a clear presentation of all essential data during a jacking operation.
- Project specific set-up information can be saved in project files and reloaded at any time, so that this data only needs to be entered once.
- Can accept a wide range of sensors fitted to the jacks and power packs for continuous display and monitoring of jack load, jack stroke, gripping system open/closed state, oil temperature, oil level and motor state.
- Automatic stroke synchronisation in both automatic lift/lower modes and manual mode
- Simple and accurate method for quickly calibrating all stroke encoders
- Comprehensive log file of all jack loads, operator commands, messages and events is stored on the control computer for later analysis. The operator may comment to the log file at any time to explain what is happening.
- Remote start and stop of all power pack motors from the control computer
- Control Computer can be running Windows XP, Vista or Windows 7 and communicates with the CAN nodes via a USB to CAN link.
- Many inbuilt safety features to prevent unsafe operation of the jacking system
- Tested and certified to European Electro Magnetic Conformance standards for reliable operation in all site conditions.
- Simulation mode for training and demonstration purposes, which can be set up by the user to run any combination of jacks and power packs.



Radiated Emission Test Set-up Back View

## DL-M control system

DL-M pendant control systems can be used by a single operator to monitor and control up to 12 jacks and are operated from a control box as shown below (DL-M4 shown). The DL-M system has none of the automation of the DL-P40 computer control system. However, it offers a practical low cost alternative to the DL-P40. The DL-M The control box is weatherproof to IP 55 and is suitable for use outside in all weathers and in temperatures ranging from  $-10$  to  $+50$  deg C.



The wiring and junction boxes on the jacks and power packs are the same for both the DL-P40 and DL-M systems, allowing the DL-M system to be used as a back up to the DL-P40 computer control system with a very quick changeover from one system to the other.



DL-M8 control box



DL-M control system being used for final alignment of bridge deck sections



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Our jacking systems are under continuous development in response to feedback from our customers and our own experience in using this equipment. The information contained in the brochure is subject to change without notice.