

# **CS-400 Rig**

## **CRAWLER & TRUCK MOUNTED**



**Chang Shin International Co., Ltd.**

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\* Brief Operating Manual

# 1. Introduction

- ▶ **C**ustomers **S**atisfaction **I**nternationally

Chang Shin International, established in 1993, has been manufacturing drilling equipments like Drilling Rigs, Hammers and Bits. And we are serving the drilling and construction markets to more than 30 countries with our all products.

Especially the most important feature of our drilling rig is powerful and fast performance in deep hole drilling.

Our various model will help your selection, And our high technical skill will help your all requirement at your drilling business.



## 2. Model Classification



**Truck Mounting Type**



**Crawler Type**

**Drilling  
Depth**

**CS-400DHR**

**500m**

CS-200

**CS-400**

CS-1000DHR

**1000m**

CS-600

CS-1000

CS-1500DHR

**1500m**

CS-1500

CS-2000DHR

**2000m**

CS-2000

# 3. Specification

- ▶ 1. CS-400 Drilling Rig
- ▶ 2. CS-400 DHR Drilling Rig

# Drilling Rig Specification

**Model : CS-400\_STANDARD**

## **DIMENSION & WEIGHT**

WIDTH	:	2	M
HEIGHT-TRANSPORT	:	2.45	M
LENGTH-TRANSPORT	:	5.4	M
HEIGHT-MAST UP	:	6	M
WEIGHT(DRY)	:	7.5	Ton

## **ENGINE**

MODEL	:	D6AZ-G2
POWER	:	165KW / 1800rpm
FUEL TANK	:	200 Litter
COOLING	:	Water Cooling

## **ROTARY HEAD**

TORQUE	:	500 / 250 kgf*m
RPM	:	0 ~ 60 / 0 ~ 120 rpm

## **FEED SYSTEM**

HEAD TRAVLE	:	5 m
PULL UP CAPACITY	:	17,270 kgf
PULL DOWN CAPACITY	:	8,808 kgf
HOLD BACK CAPACITY	:	10,990 kgf
MAX. FEED SPEED UP/DOWN	:	25 / 49 m/min

## **HYDRAULIC SYSTEM**

PUMP	:	Main 112cc * 2 + 1 service pump
	:	Operting Pressure 220bar(Max.350Bar)
TANK	:	150 Litter
OIL FILTER	:	10 $\mu$ m
COOLING	:	Air Cooling

## **OUTRIGGER(LEVELING JACK)**

CAPACITY	:	8,080 kgf/each
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<i>GROUND CLEARANCE</i>	:	<i>1,400</i>	<i>mm</i>
<i>WITH</i>	:	<i>3</i>	<i>M</i>

#### **DRILL PIPE & CASING**

<i>DRILL PIPE LENGTH</i>	:	<i>4</i>	<i>M</i>
<i>DRILL PIPE DIAMETER</i>	:	<i>114</i>	<i>mm</i>
<i>MAX. CASING DIAMETER</i>	:	<i>16</i>	<i>inch</i>
<i>DRILL ROD BREAKOUT TORQUE</i>	:	<i>4</i>	<i>Ton*m</i>

#### **STANDARD EQUIPMENT**

<i>WINCH</i>	:	<i>1,500</i>	<i>kgf (40M × 10mm)</i>
<i>DRILL ROD SPANNER</i>	:	<i>For 114mm drill rod</i>	

#### **CRAWLER BASE**

<i>SPEED</i>	:	<i>2.5</i>	<i>km/h</i>
<i>GROUND CLEARANCE</i>	:	<i>363</i>	<i>mm</i>
<i>TRACK SHOE WIDTH</i>	:	<i>380</i>	<i>mm</i>
<i>TUMBLER DISTANCE</i>	:	<i>1,990</i>	<i>mm</i>

#### **OPTIONAL EQUIPMENT**

<i>MUD MUMPS</i>	:		
<i>ELECTRIC WELDING MACHINE</i>	:	<i>250A / DC</i>	
<i>AIR COMPRESSOR</i>	:		
<i>ROTARY HEAD CHANGE</i>	:		
<i>BASE TYPE CHANGE</i>	:	<i>SKID TYPE</i>	<input type="checkbox"/>

**\* Optional equipment need some discussion.**

# Drilling Rig Specification

**Model : CS-400DHR\_STANDARD**

## **DIMENSION & WEIGHT**

CARRIER	:	HYUNDAI 5TON TRUCK
WIDTH	:	2.5 M
HEIGHT-TRANSPORT	:	3.47 M
LENGTH-TRANSPORT	:	8,84 M
HEIGHT-MAST UP	:	7.5 M
WEIGHT(DRY)	:	14.6 Ton

## **ENGINE**

MODEL	:	D6AZ-G2
POWER	:	165KW / 1800rpm
FUEL TANK	:	200 Litter
COOLING	:	Water Cooling

## **ROTARY HEAD**

TORQUE	:	500 / 250 kgf*m
RPM	:	0 ~ 60 / 0 ~ 120 rpm

## **FEED SYSTEM**

HEAD TRAVLE	:	5 m
PULL UP CAPACITY	:	17,270 kgf
PULL DOWN CAPACITY	:	8,808 kgf
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MAX. FEED SPEED UP/DOWN	:	25 / 49 m/min

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PUMP	:	Main 112cc * 2 + 1 service pump
	:	Operting Pressure 220bar(Max.350Bar)
TANK	:	150 Litter
OIL FILTER	:	10 $\mu$ m
COOLING	:	Air Cooling

## **OUTRIGGER(LEVELING JACK)**

<i>CAPACITY</i>	:	<i>8,080</i>	<i>kgf/each</i>
<i>GROUNG CLEARANCE</i>	:	<i>1,400</i>	<i>mm</i>
<i>WITH</i>	:	<i>3</i>	<i>M</i>

#### **DRILL PIPE & CASING**

<i>DRILL PIPE LENGTH</i>	:	<i>4</i>	<i>M</i>
<i>DRILL PIPE DIAMETER</i>	:	<i>114</i>	<i>mm</i>
<i>MAX. CASING DIAMETER</i>	:	<i>16</i>	<i>inch</i>
<i>DRILL ROD BREAKOUT TORQUE</i>	:	<i>4</i>	<i>Ton*m</i>

#### **STANDARD EQUIPMENT**

<i>WINCH</i>	:	<i>1,500</i>	<i>kgf (40M × 10mm)</i>
<i>DRILL ROD SPANNER</i>	:	<i>For 114mm drill rod</i>	

#### **Truck**

<i>Model</i>	:	<i>HYUNDAI 5TON TRUCK</i>	
<i>Power</i>	:	<i>290Ps</i>	
<i>Length</i>	:	<i>7,875</i>	<i>mm</i>
<i>Weight</i>	:	<i>7,600</i>	<i>kgf</i>

#### **OPTIONAL EQUIPMENT**

<i>MUD MUMPS</i>	:	
<i>ELECTRIC WELDING MACHINE</i>	:	<i>250A / DC</i>
<i>AIR COMPRESSOR</i>	:	
<i>ROTARY HEAD CHANGE</i>	:	
<i>BASE TYPE CHANGE</i>	:	<i>SKID TYPE <input type="checkbox"/></i>

**\* Optional equipment need some discussion.**

## 1 . Calculation sheet of the drilling rig.

Drilling rig has much "Optional" specifications by requirements of customer.

But the specification of our standard model is calculated as a standard, not including optional function.

For the specification calculating, total drilling depth and drill rod and drilling tool, etc. all drilling condition should be considered.

For example the "CS-400 Drilling rig".

### 1.1 CS-400 Drilling Rig Specification Calculation Sheet

- Total Drilling Depth : Up to 400 meter.
- Drilling Rod : API 4 1/2" \* 0.337t (OD114.3mm \* 5.86t) / 22kg/m.
- Rotation Speed : For DTH Drilling Max 60rpm / For Rod Change Max 120rpm.
- Rotation Torque : 10" Bit Min.300kgf\*m

#### 1) Pull Up Power

Total Drill Rod Weight

$$\Rightarrow 400\text{m} * 22.32\text{kg/m} = 8,928\text{kgf}$$

#### 2) Feed Cylinder Dia

$$\Rightarrow 10\text{cm} \Rightarrow A = 3.14 * 10 * 10 / 4 = 78.54\text{cm}^2$$

$$\text{Feed System} \Rightarrow \text{Feed Force} = 17.270\text{kgf} (\text{At max. } 220\text{bar})$$

$$\text{Safe Factor} \approx 17.270 / 8,928 \approx 2$$

#### 3) Feed Speed

$$\Rightarrow \text{Required Speed} = 25\text{m/min}$$

$$\text{Feed Cylinder Lower Area} = 78.54\text{cm}^2$$

$$\text{Feed Cylinder Upper Area} = 40.05\text{cm}^2 (\text{Rod Dia} = 7\text{cm}).$$

$$\therefore \text{Displacement} = 78.54\text{cm}^2 * 20.8\text{cm/s} * 2EA \Rightarrow 196\text{Litter/min.}$$

$$\text{And Feed Down Speed} = 49\text{m/min.}$$

#### 4) Power Head Rotation

$$\Rightarrow \text{Required Torque} = 500\text{kgf*m}$$

Gear Ratio = 3 : 1

Hydraulic Motor Torque = 83kgf\*m(At 170bar)

$\therefore 83\text{kgf}\cdot\text{m} * 2 * 3 = 500\text{kgf}\cdot\text{m}$

And Displacement = 65Litter/min \* 2EA => 130Litter/min.

### 5) Engine Power

Max Required Displacement for Feed system

= 196LPM => Pump1

Max. Pressure

= 220bar

=>  $196 \times 220 / 612 \approx 70\text{kw}$

During general operating pull out works of drill rod need max power.

But sometimes pull out and rotation should be operated at same time.

Therefore safety factor is needed for engine power about "S = 2"

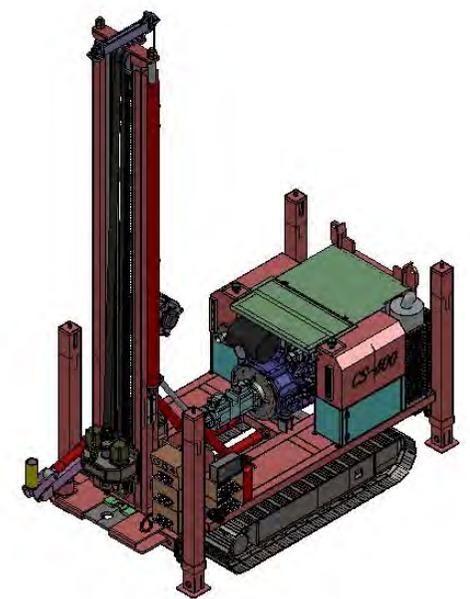
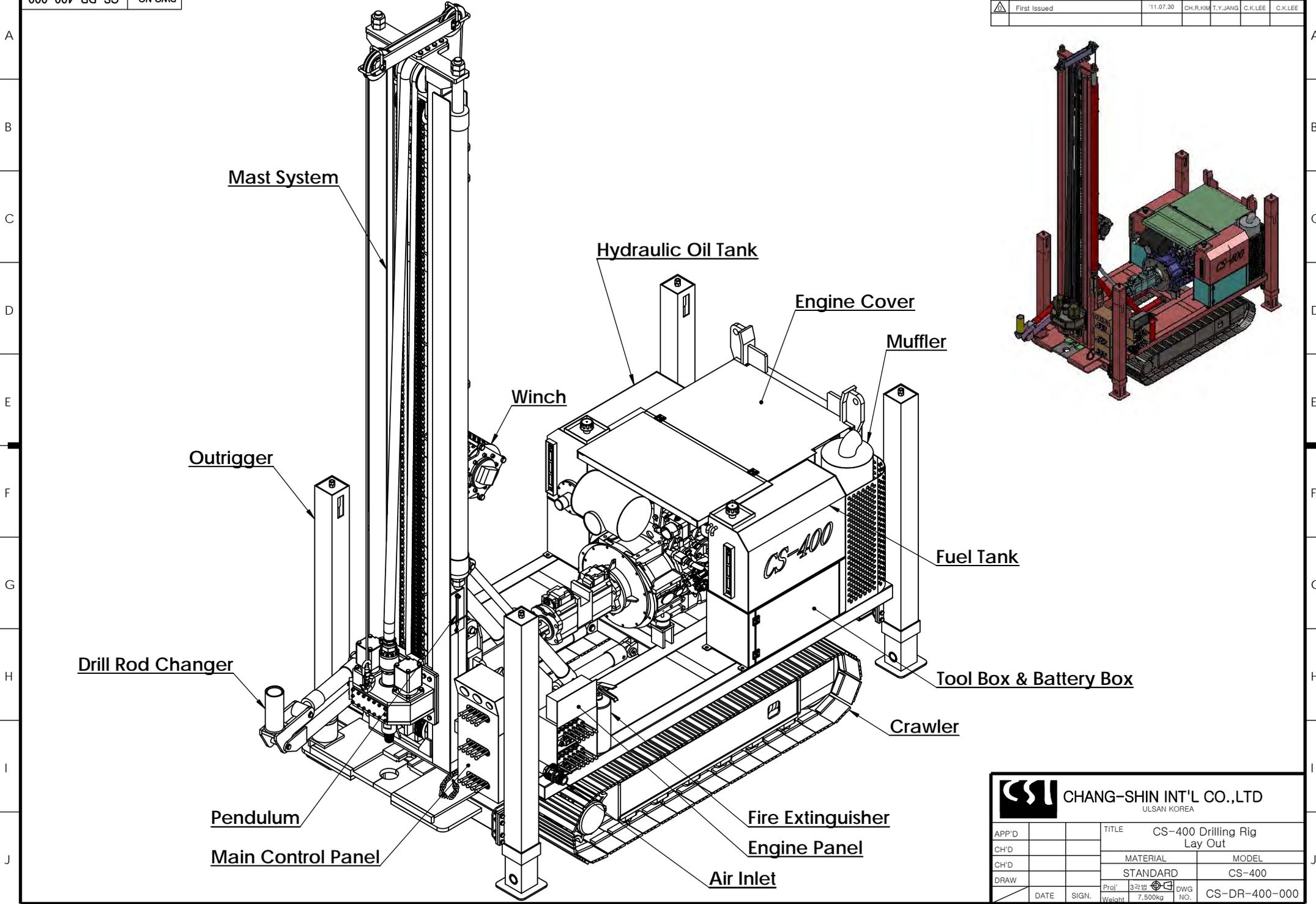
### 6) Hydraulic Pump => T5V112DP

As above calculations, all standard model can be computed its specification.

And for "Optional requirements" the engine power and hydraulic parts should be changed.

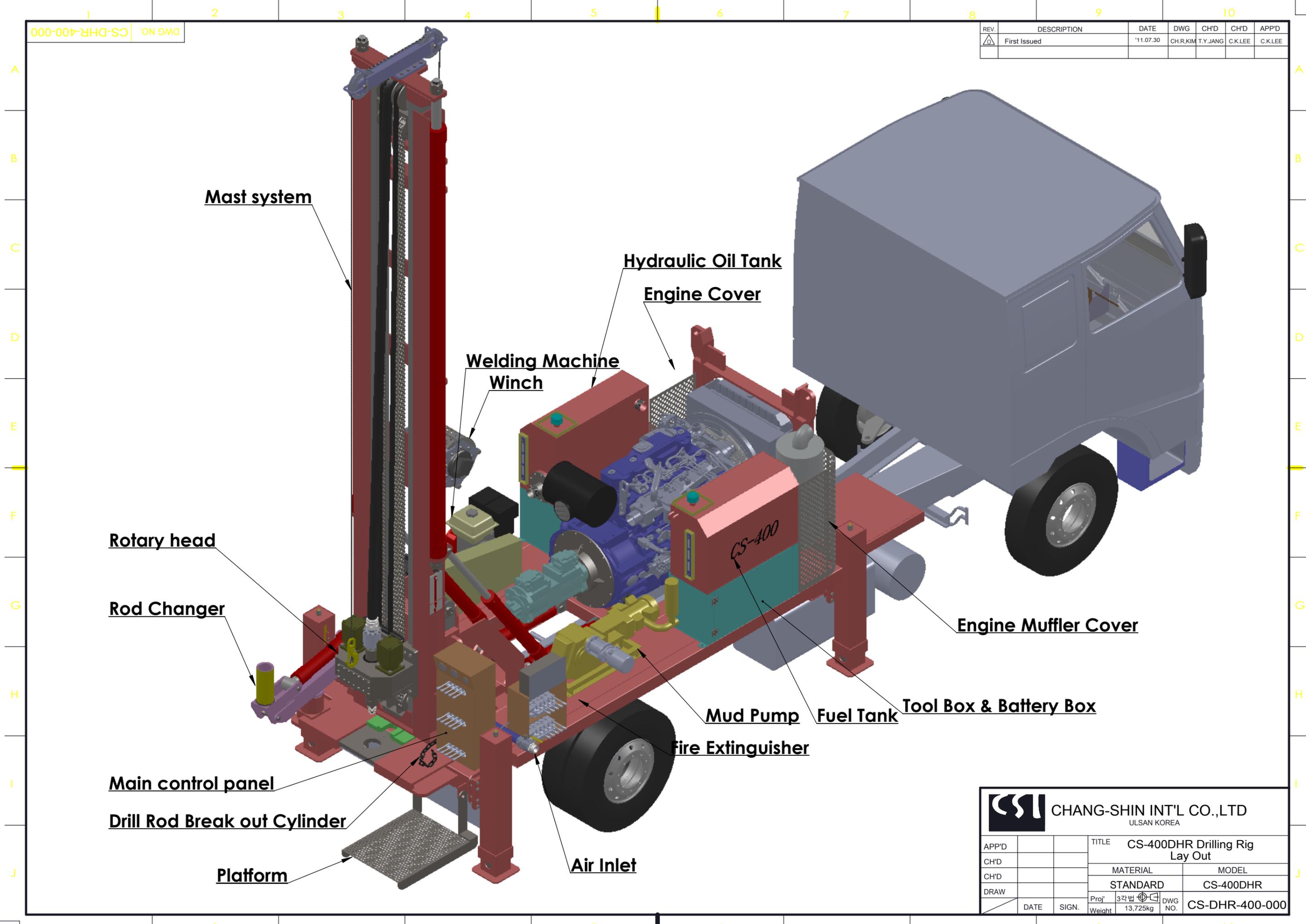
## 5. Drawings & Parts

REV.	DESCRIPTION	DATE	DWG.	CH'D	CH'D	APP'D
△	First Issued	'11.07.30		CH.R.KIM	T.Y.JANG	C.K.LEE



		<b>CHANG-SHIN INT'L CO.,LTD</b> ULSAN KOREA	
APP'D		TITLE CS-400 Drilling Rig Lay Out	
CH'D		MATERIAL STANDARD	MODEL CS-400
CH'D			
DRAW		Proj' 3차별	DWG NO. CS-DR-400-000
DATE	SIGN.	Weight 7,500kg	

REV.	DESCRIPTION	DATE	DWG	CH'D	CH'D	APP'D
△	First Issued	'11.07.30	CH.R.KIM	T.Y.JANG	C.K.LEE	C.K.LEE



 <b>CHANG-SHIN INT'L CO.,LTD</b> ULSAN KOREA		TITLE CS-400DHR Drilling Rig Lay Out	
		MATERIAL	MODEL
APP'D		STANDARD CS-400DHR	
CH'D		Proj 3각법	DWG NO. CS-DHR-400-000
CH'D		Weight 13,725kg	
DRAW		DATE	SIGN.

# Brief Operating Manual

## For CS-400 Drilling Rig



ISO9001



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## 1. Specification

### 1-1. Power : Engine

- HYUNDAI D6AZ G2(184KW/1800Rpm)

### Hydraulic Pump

- T5V112DP

### 1-2. Working Capacity

- Max Pull Up : 17,270kgf(220k)
- Torque of Rotary Head : Max. 500kgf\*m
- Pull Down : 8,808kgf(220k)
- Hold Back : 10,990 kgf(140k)
- Drilling Depth : to 400meter

### 1-3. Operating Speed

- Pull Up Speed : 25m/min
- Pull Down Speed : 49m/min
- Rotation Speed : 1st 60rpm / 2nd 120rpm
- Travel Speed : 2.5km/H

### 1-4. Equipment

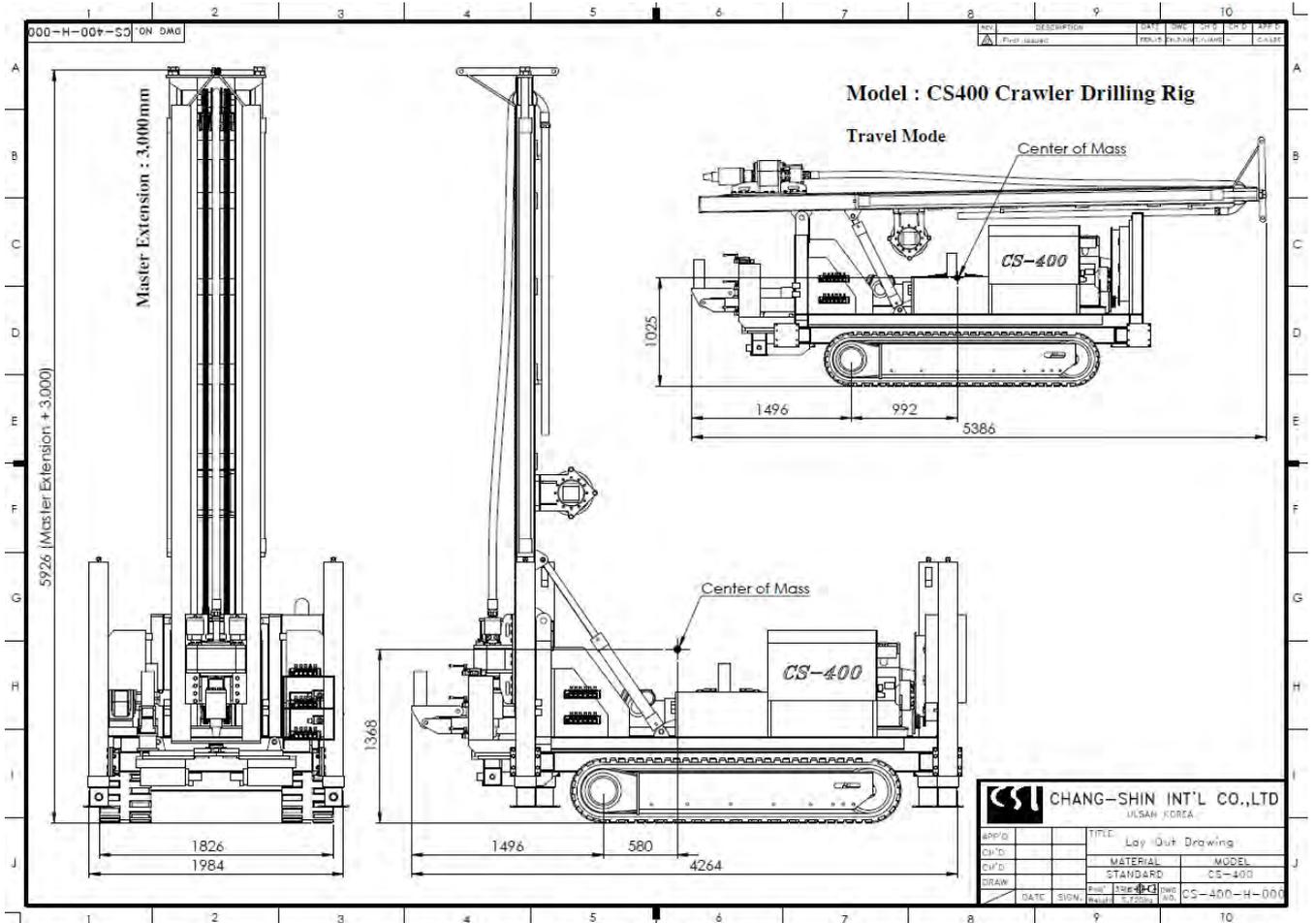
- Outrigger(Leveling Jack) : 4
- Electric Welding Machine(option) : Option
- Water Pump(option) : Option
- Winch : 1.5Ton Lifting
- Drill Rod Changer
- Drill Rod Clamp

### 1-5. Lay out : Length : 5.4 M

Width : 2 M

Height : 2.45 M(Mast Down)

6 M(Mast Up) + 3 M(Extension)



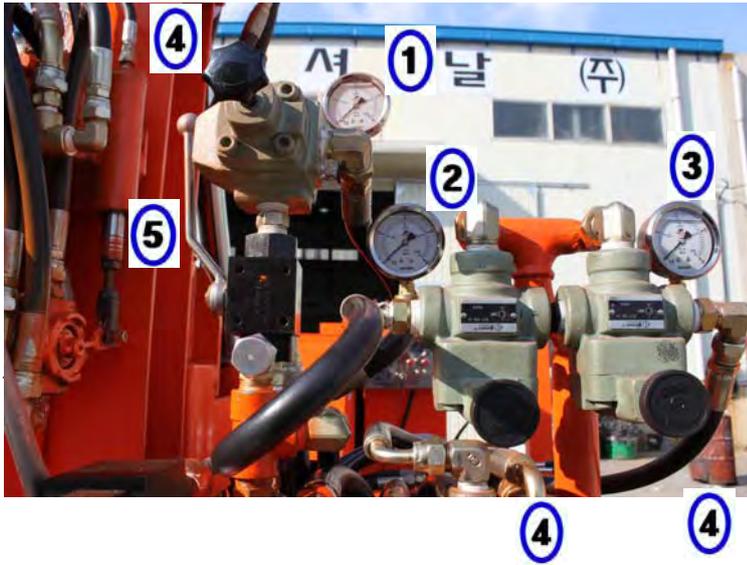
## 2. Operation

### 2-1 Control Panel Description

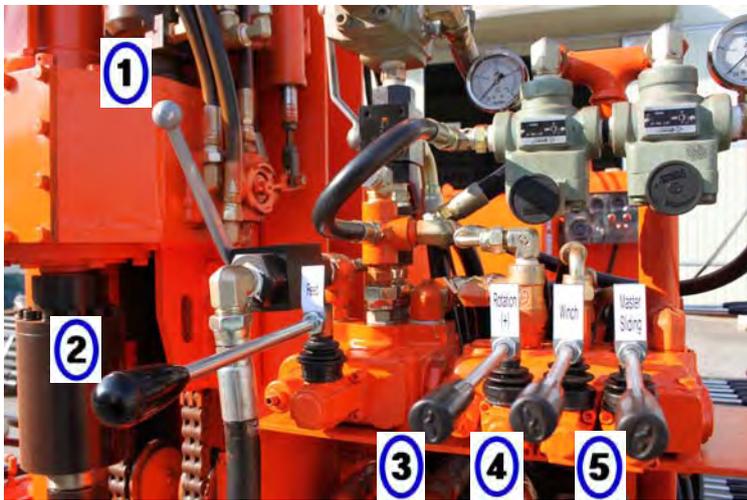
#### 2-1-1 Main Control Panel



- \* **Position**  
Front Right side of Rig
- \* **Composition**
  - Pressure Gauge
  - Feed Control
  - Power Head Rotation Control
  - Clamp Control
  - Water Pump / Welder Control



**1<sup>st</sup> stage of main panel**  
**No.1 Hold Back / Pull Up Pressure**  
**No.2 Pull Down Pressure**  
**No.3 Power Head Rotation Pressure**  
**No.5 Hold Back / Pull Down**  
 The Pressure can is controlled by  
 the each no.4 knobs.



**2<sup>nd</sup> Stage of main panel**  
**No.1 Flow Control Lever**  
 - Water Pump, Travel Speed, Welder  
**No.2 Feed Up - Down**  
**No.3 Power Head Rotation Speed +**  
**No.4 Winch Control**  
**No.5 Master Sliding**

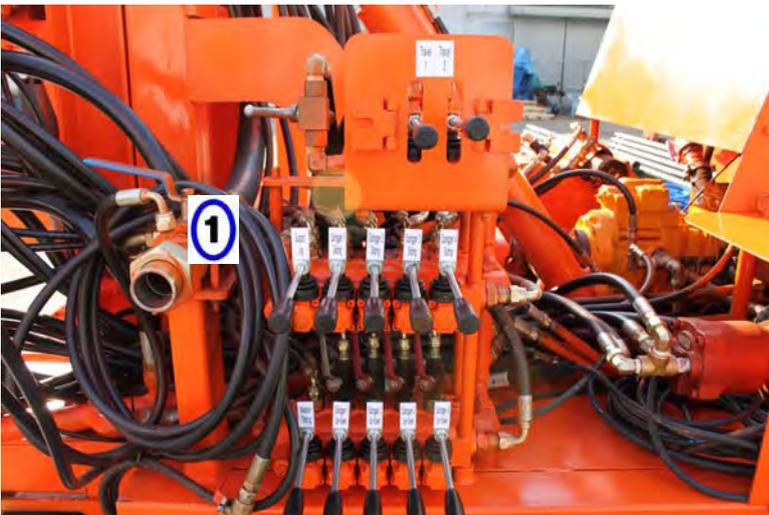


**3<sup>rd</sup> Stage of main panel**  
**No.1 Power Head Rotation**  
**No.2 Feed Speed +**  
**No.3 Power Head Rotation**  
 Low / High Speed  
**No.4 Drill Rod Breaking Cylinder**  
**No.5 Engine Power Control**



- 4<sup>th</sup> Stage of main panel**  
**No.1 Up-Welder / Down-Water Pump**  
**No.2 Rod Spanner Control**  
**No.3, 4 Rod Center Plate**  
**No.5, 6 Jaw Control**

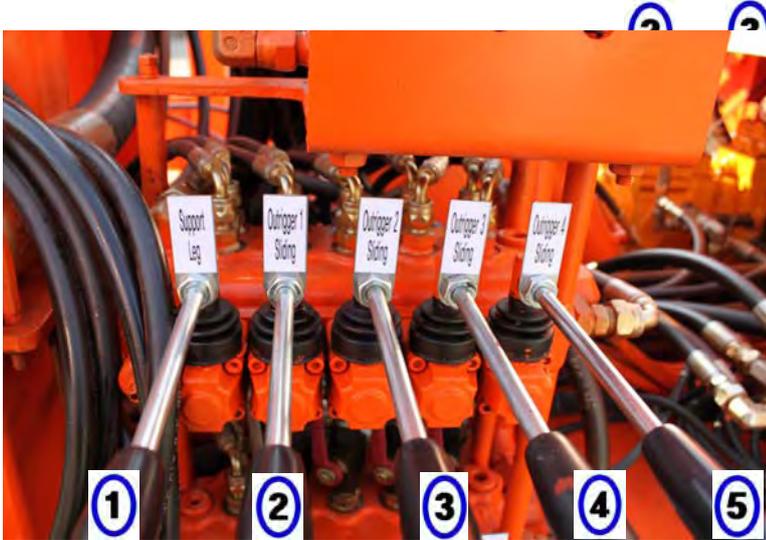
**2-1-2 Service Control Panel**



- \* Position\* Position**  
**Right side of Rig**  
**\* Composition**  
 - Travel  
 - No 1 ~ 4 Leveling Jack Control  
 - Mast Tilting  
 - Support Jack Control  
**No.1 Air Inlet**



- 1<sup>st</sup> Stage of Service Panel**  
**No.1 High Speed for**  
**Travel(Horizontal)**  
**Water Pump & Welder(Vertical)**  
**No.2, 3 Travel Motor Control**  
**\* Close the safeguard during not**  
**Moving operation.**



**2<sup>nd</sup> Stage of Service Panel**

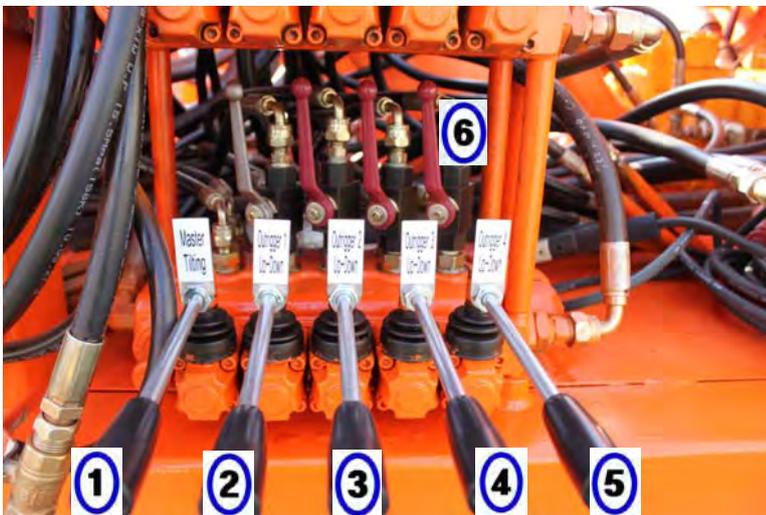
**No.1 Support Jack Control**

**\*The Support Jack is used for deep drilling.**

**\*Under the Rod Center Plate.**

**No.2 ~ 5**

**Leveling Jack Sliding**



**3<sup>rd</sup> Stage of Service Panel**

**No.1 Mast Tilting**

**No.2 ~ 5 Leveling Jack Up-Down**

**No.6 Leveling Jack Stop Valve**

**\* Close the stop valve after level setting.**

**2-1-3 Engine Panel**

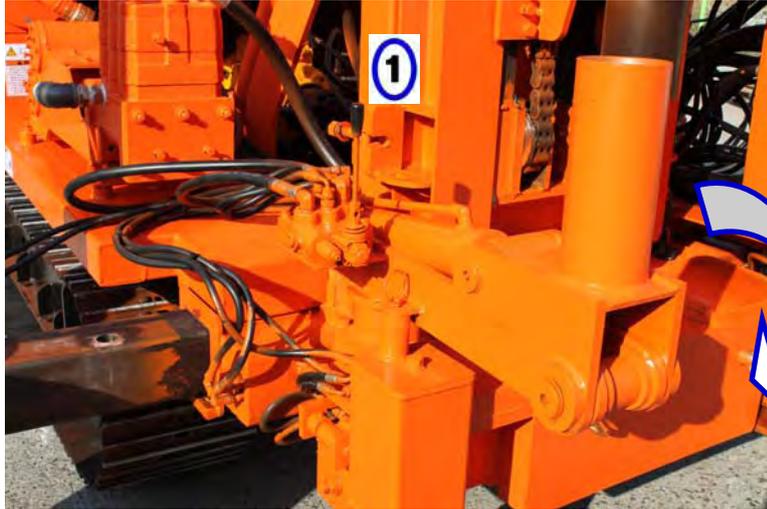


**No.1 Engine Tachometer**

**No.2 Key**

**No.3 Engine Starter Power On-Off**

### 2-1-4 Drill Rod Changer Control



#### No.1 Rod Changer Tilting

- \* **Be careful swing the rod changer.**
- \* **Tilting is operated by hydraulic control, swing is operated by manual operating.**

## 3. Starting

- Before engine start, check all control lever. All lever should be in neutral.
- And carefully check is there any oil leakage or other unusual condition.
- After checking, on the “engine panel” turn on the No.3 switch and the key.
- After Engine Start, Check the engine “RPM”, The Max rpm is 1800rpm.
- The rated rpm is 1000rpm and engine rpm (power) can be controlled by main control panel 3<sup>rd</sup> stage No.5 Lever.

## 4. Cautions

- During Traveling, Don't put your foot under the steel track.
- During Leveling the Rig, Don't put your foot under leveling pad.
- During Mast tilting (rising), Carefully check around the mast to prevent any accident.  
And slowly move the mast.
- After leveling, turn the valve lever to “OFF” position to prevent unintended decline.
- After Mast tilting, fix the pivot bolt to clamp the mast.
- For welding, the lever control should be careful.

Turn the lever(Main Panel, 2<sup>nd</sup> Stage No.1 Lever) to “Vertical position” and slowly pull down, max 45degree. Much pull down can make some damage to the generator.

## 5. Drilling

### 5-1 Starting Drilling

- If the hammer is operated on soft ground at fast rotational speed or drilling speed with the bit not touching the rock, fatal damage could incur to bit neck, bit retaining ring, bit shank and sub screw. Therefore, you should reduce air pressure, reduce rotational speed and keep it pressed sufficiently.

### 5-2 Rotation speed

- Soft rock: 30~40 revolutions per minute

- Medium rock: 15~30 RPM

- Hard rock: 8~15 RPM

\* Normally, it is recommended to control the revolutions for the drilling speed to be 10mm per revolution.

\* Take note that the drilling speed may be varied by the condition or performance of hammer, condition of bit, air pressure, drilling depth, back pressure in hole (water or broken pieces), etc.

- Giving too much revolution (especially hard rock) make the bit wear quickly on the whole.

- If revolutions are too slow or if you push too hard, the tip of bit (side tip) wears out severely or is broken.

- If bit is damaged during drilling work

The rotational speed is not constant and the turning sounds creaking.

The size or quantity of broken pieces decreases.

Drilling speed decreases.

### 5-3 Pull-down & Hold Back

- Insufficient “Pull Down force” will cause the hammer to bounce resulting in a low blow energy to the rock causing vibration and also possible damage.

- Exceed pull down force make the bit wear.

- Recommended Pull Down Force for 4” Hammer is 250kgf ~ 500kgf, 6” Hammer is 500kgf ~ 1500kgf.

Ex) Pull Down & Hold Back Force calculation

- Hammer 6”, Drilling Rod 89mm.

=>The 89mm drilling rod weight is about 20kgf/m

=>CS-400 Drilling rig feed hydraulic cylinder diameter is 90mm.

=>Recommended Pull Down Force is 500kgf ~ 1500kgf.

=>Max drilling depth that need pull down force =  $1500\text{kgf} / 20\text{kgf/m} = 75\text{m}$

=>Pull down force by feed cylinder =  $63\text{kgf} * \text{Pressure}(\text{bar})$

=> $1500/63 = \text{About } 25\text{bar}$

Therefore to a depth of 75m, The Pull down pressure should be gradually decreased.

And more deep drilling “Hold Back” force should be applied.

For Hold Back control turn the Lever(Main panel 1<sup>st</sup> Stage No.5 Lever) **only drilling.**

The Hold Back pressure should be gradually increased as drilling depth.

\* The Hold Back Lever should be used for **only hold back during drilling.**

For pull up the drilling rod, the lever should be pull down position(Horizontal).