German Tech Precision Manufacturing Co., Ltd

Installation and Operation Instructions（manual）

For two-speed gearbox

2G600

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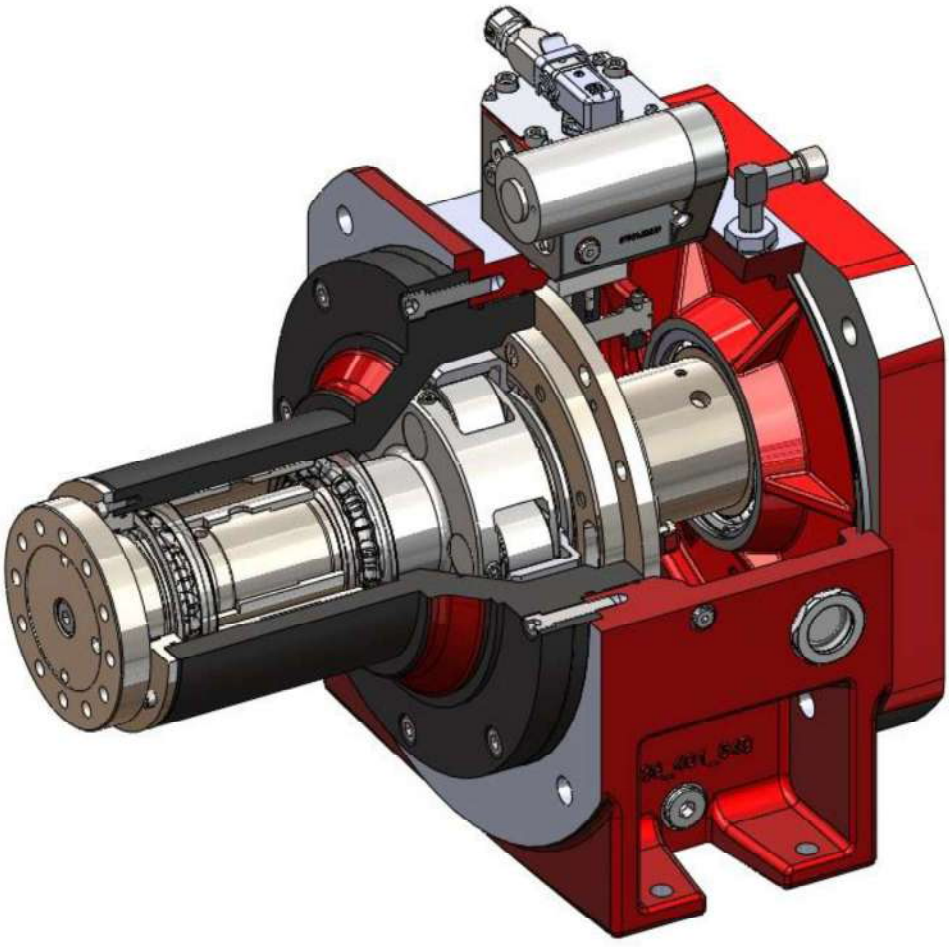
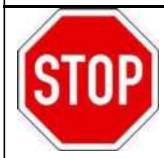


Preface

1 Important Notes

Please observe the safety note in this manual!

	SERIOUS DANGER Can cause injury to personal and/or damage to property.
	DANGER Can cause slight or small injury.
	HAZARDS Can be harmful for the drive and environment
	Points and useful information.

Caution and safety note

All users of GTP are responsible for their own work safety.

(All personnel in charge of assembly and operation have to be familiar and comply with all safety instruction, to avoid the injury to personal and/or damage to gearbox.)

(All personnel in change of assembly and electricity have to be trained by GTP and make sure the proper operation of gearbox.)

(At any time the instruction need to be observed, for ensuring the correct operation and claim right within warranty period. Therefore, please read this instruction very carefully before commissioning!)

GTP cannot provide warranty, if any:

➢ Incorrect, improper use;

➢ Damage caused by using non-genuine parts or non-approved oil, or repair done by customer;

➢ Insufficient oil;

➢ Damage caused by accident or improper transportation;

➢ Out of scope of application;

➢ Defect or damage caused by motor(including belt), break off of the power transmission or defective of lubrication.

This instruction includes very important information about repair. Please keep it close to the gearbox.

In any case improper operation will make the warranty invalid even no description in this instruction!

Waste disposal, please observe current regulations.
Uncollected cast, gears, shafts and bearings will be treated as scrap.
Waste oil collection need to be treated according to local environment protection regulations

2 Safety Notes

2.1 General introduction

During operation or after operation, surface of gearbox can generate high temperature.

Only qualified personnel can carry out the works as follows:

About transportation, storage, installation, connection, operation, maintenance and service, please read carefully below information and documents:

- ➢ Installation instruction
- ➢ Warning and notes on the gearbox
- ➢ Regulation and requirements for special system
- ➢ Safety regulation in the region and country

Personnel will be injured seriously due to below reasons:

- ➢ Use improperly or wrong installation or operation;
- ➢ Without authorization, disassemble the necessary protection cover or housing.

2.2 Application

The gearbox is designed for industry system, mainly for machine tool drives.

Please find technical data and information on the nameplate

It is very necessary to observe all the instruction!

2.3 Delivery

The shipment must be inspected for completeness and transport damages immediately after the delivery.

If damage is found, this must be communicated immediately to the transport company and confirmed by this company(may postpone the installation）.

Please use proper and safe equipment to transport the gearbox.

2.4 Storage and start-up

Gearbox is designed with channel lubrication system. No oil inside the gearbox during transportation.

Store the gearbox long time or store in an improper environment (high humidity, sea freight,) can make the gearbox inside and outside rusty.

The gearbox is also useable for other systems which need torque increasing and/or speed reducing.

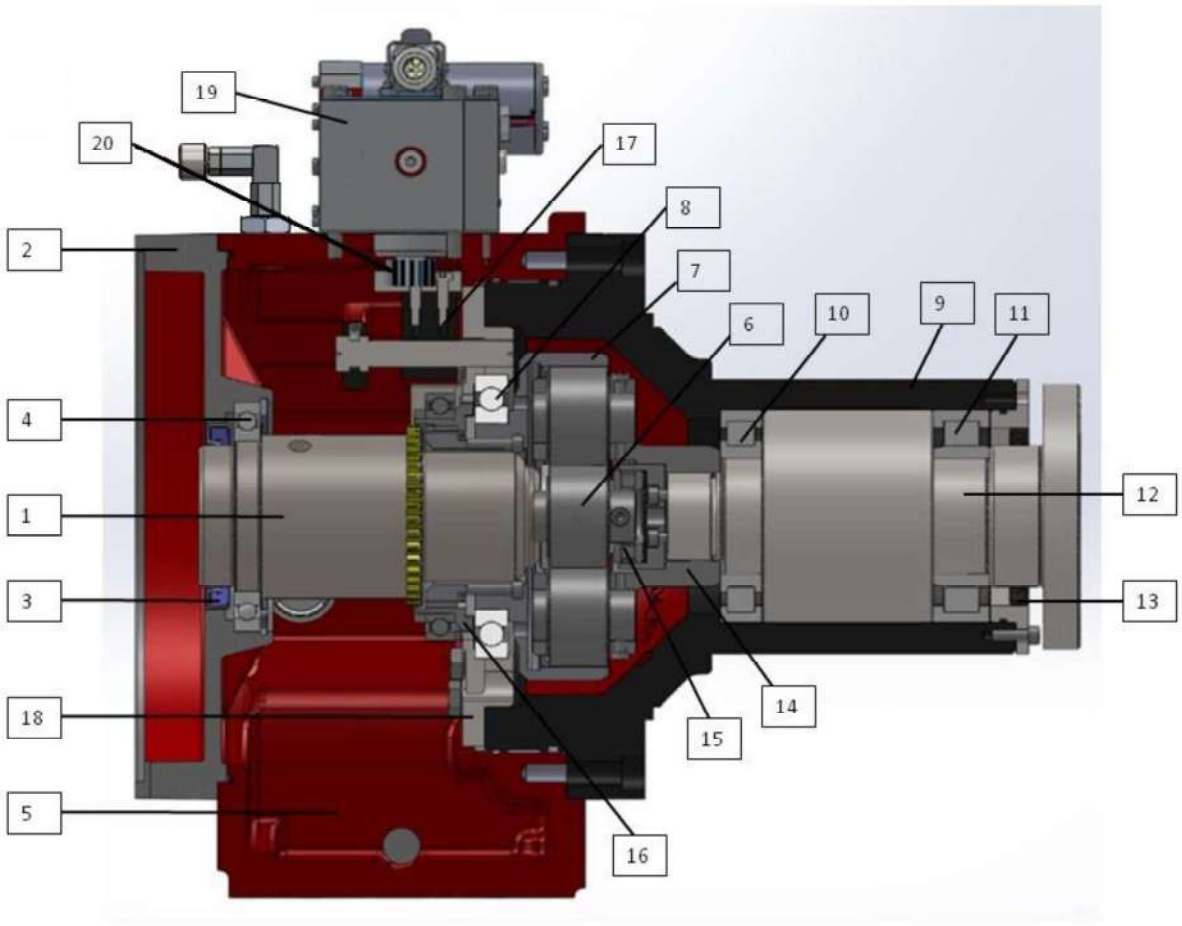
With different installation positions the gearbox can be used in Vertical Lathe and Horizontal B5, Vertical Machining center V1 or V3.

Before starting the gearbox, make sure oil channels are connected properly to avoid any damage due to wrong connection.

Before powering up the gearbox, make sure that the oil path is connected correctly to avoid damage caused and the lubrication system is activated.

3 Gearbox structure

Connecting parts	Input	Output	Shifting system
1.hub	6.sun gear	9.bearing housing	16.sliding sleeve
2.adpater plate	7.ring gear	10.11output bearing	17.shift fork
3.hub seal	8.ring gear bearing	12.output shaft	18.brake disc
4.hub bearing		13.radial shaft seal	19.shift unit
Housing		14.planet carrier	20.shift rack
5.Gearbox housing		15.sun gear bearing/ with cup spring	

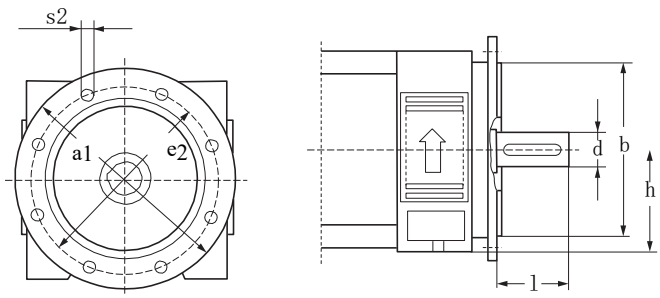


3.1 Technical data

Type	2G600
Nominal power	Max.63kW
Nominal speed	1000rpm
Nominal input torque	Max.600Nm
Max. input speed i≠1	5000rpm
Max. output torque i = 1.00 i = 4.00 i = 5.00	 600Nm 2400Nm 3000Nm
Weight	about177kg
Motor dimension	
h	180
d	65/80
l	140-0.2/170±0.2
b	300
e2	400
a1	450
s2	18

Caution:

Control braking time to ensure the brake torque should be less than the moments of inertia of gearbox.



3.2 Installation positions

Horizontal B5(fig. 1, fig 2, fig 3)

Fig 1

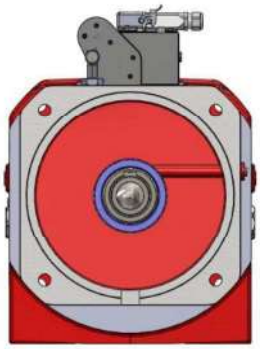


Fig 2

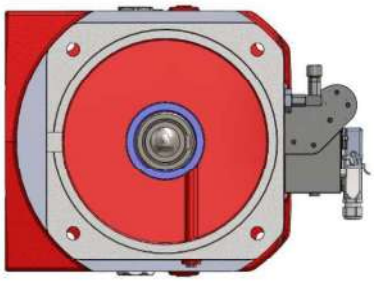
Fig 3 Horizontal B5 rotate 90°

Shift unit on right side, gearbox urned 90°around axial (view to input end)

Vertical (fig 4, fig5)

Fig 4 Vertical V1

Fig 5 Vertical V3



CAUTION

The breather outlet must always be at the top, regardless of the installation position.

3.3 Main dimensions and models

GTP two-speed gearbox 2G600 is useable as below models:

Input:
Motor is installed onto the gearbox by a flange.

Two sizes of motor: center height（AH）：(160mm / 180 mm / 200 mm)。
Closed version (adapter plate delivered with. shaft seal 、 bearing and drive hub, if necessary adapter plate bearing can be taken away).

Output:

Standard design (belt output), design of bearing can allow high radial force.

Shaft output version

Shift unit can be mounted on the right /top side of the gearbox.

3.4 Backlash

GTP two-speed gearbox 2G600 backlashes:

20 arcmin (measured on the output shaft, ambient temperature 20℃ before starting the gearbox)

3.5 Lubrication

For the first starting of the gearbox, the correct level of the lubricating oil should be at the middle of the oil sight glass in accordance with the requirements of the operating manual.

The pump, oil tank and heat exchanger components must be arranged below the gearbox oil level.
Connecting an oil return with a proper angle assures smooth oil return.

3.5.1 Splash lubrication

Splash lubrication is standard for GTP 2G gearbox B5 horizontal installation, it is applicable for high frequency gear shifting, varied operating speed and long standby time for tools changed.

The lubricated oil level should be in the middle of oil sight glass.

NOTE:

In case of oil sight glass is not visible when gearbox is installed on special angle, please take a tube with scale to replace oil sight glass.

3.5.2 Recirculating lubrication

Continuous operation, or intermittent operation in the same gear for a long time running or high speed and short standby time must use this kind of lubrication mode.

For 2G600, the vertical V1 and the inverted V3 must be used with recirculating lubrication, and the arrangement of recirculating lubrication will be different according to the requirements of its operating temperature.

Some applications operate at low temperature require a suitable oil cooling system.

The application is various according to the different models of gearboxes.

In order to reach the best cooling performance of the gearbox and avoid affecting the lubrication, different oil ports and connection modes must be used according to the different installation positions and operation methods.

3.5.3 V1 / B5 Recirculating lubrication

Take out the oil plug and connect the oil inlet pipe.

The volume of lubricating oil is in minimum 3.0 liters / minute.

Remove one of the sight glass and connect the oil outlet pipe, the screw size (M42x1.5).

To maintain oil running smoothly and avoid hot oil stay inside of the gearbox (pipe diameter at least 20mm).

3.5.4 Recirculating lubrication with heat exchanger

The recirculating lubrication system with heat exchanger can ensure further reduction of the oil temperature.

The size of the oil tank should be at least 10 times of requested circulating oil volume or 20 liters.

GTP recommends to install an oil level sensor in the auxiliary tank and avoid damage to the gearbox due to lack of oil.

Install a filter(60 μ m) and a safety valve at oil inlet pipeline.

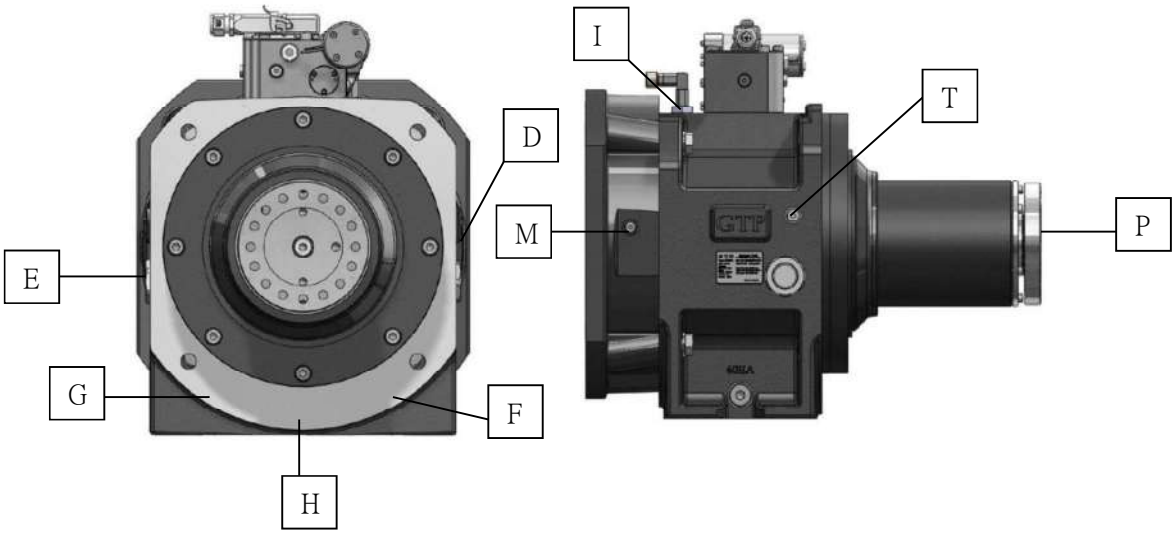
The oil return pipe should be located lower than the gearbox oil outlet, in order to prevent the oil level rising in the gearbox.

3.5.5 Lubricant

	Description	Application	Remarks
Gearbox oil	HLP46 to ISO VG46	Recirculating lubrication with heat exchanger	Also for recirculating without lubrication heat exchanger
	HLP32 to ISO VG32	Recirculating lubrication with heat exchanger	
	HLP22 to ISO VG22		

3.5.6 Ports and connections for initial fill/oil change

Installation Position	Inlet ports	Outlet ports
V1	I	P–flange output
V3		D
B5		F,G,H
B5 rotate		D



3.5.7 Ports connection at max. speed

Connecting T to an integral lube oil system is mandatory in applications with maximum speeds of 5000 rpm.

Furthermore, a gearbox oil cooler >0.3 kW and a circulating oil volume of >20 liters is required.

When using the gearbox at max. speed:

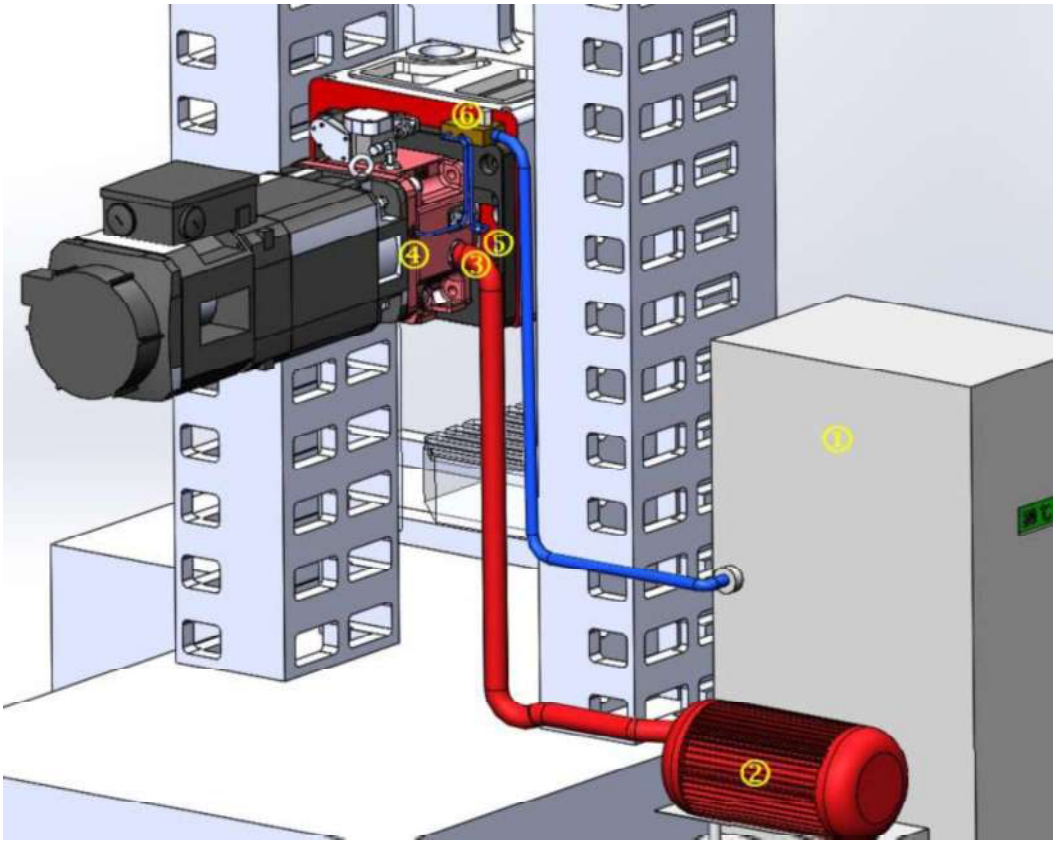
- Please make sure to connect M and T, oil quantity should be 4 liters/min, oil pressure should be 3bar.

The principle factor in determining the oil supply volume is always the volume that flows out of the oil return.
If cannot use K, R as oil inlets, max. speed is not reachable.

Installation position	Inlet ports	Max. pressure	Outlet ports
B5	**M** (1.0 dm^3/min)and **T** (2 dm^3/min)	2bar	D or E
V1	**M** (1.0 dm^3/min)and **T** (2 dm^3/min)	2 bar	E
V3	**M** (1.0 dm^3/min)and **T** (2 dm^3/min)	2 bar	D

Example of connections for recirculating lubrication of gearbox horizontal position

1. Oil cooler
2. Oil pump
3. Oil Outlet (E)
4. Oil Inlet (M)
5. Oil lnlet (K)
6. Oil flow rate and pressure sensor



3.6 Gearbox shifting

Pin 2 and Pin3 will be affected by 24 V voltage and rotating direction is defined by the applied polarity.

During the shifting, make sure the spindle motor shaft oscillating ±5°/s.

Angle**[°/sec]**	Speed**[rpm]**	Time**[sec]**
5	1.00	0.83
	2.00	0.42
	3.00	0.28
	4.00	0.21
	5.00	0.17

Limit switch control current : 0.1 – 0.5 A
Chang over control current : 5 A.

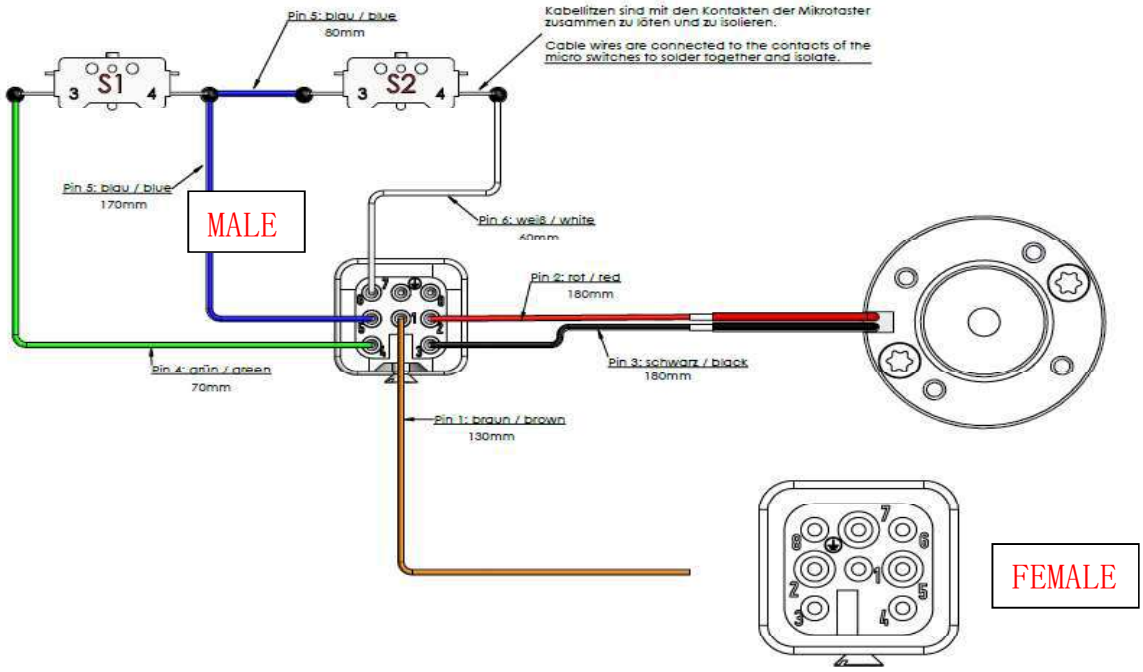
If the limit switches detect ,gears are no longer securely engaged, emergency shut-off must be initiated through the control system.
Electromagnetic fields can falsify the limit position monitoring currents.
This can be prevented by rerouting or shielding the circuit.

Diagram for shift unit with two positions:

1st gear ==>e.g. 4:1

2nd gear ==> 1:1

3rd gear ==> neutral position, idling (option)

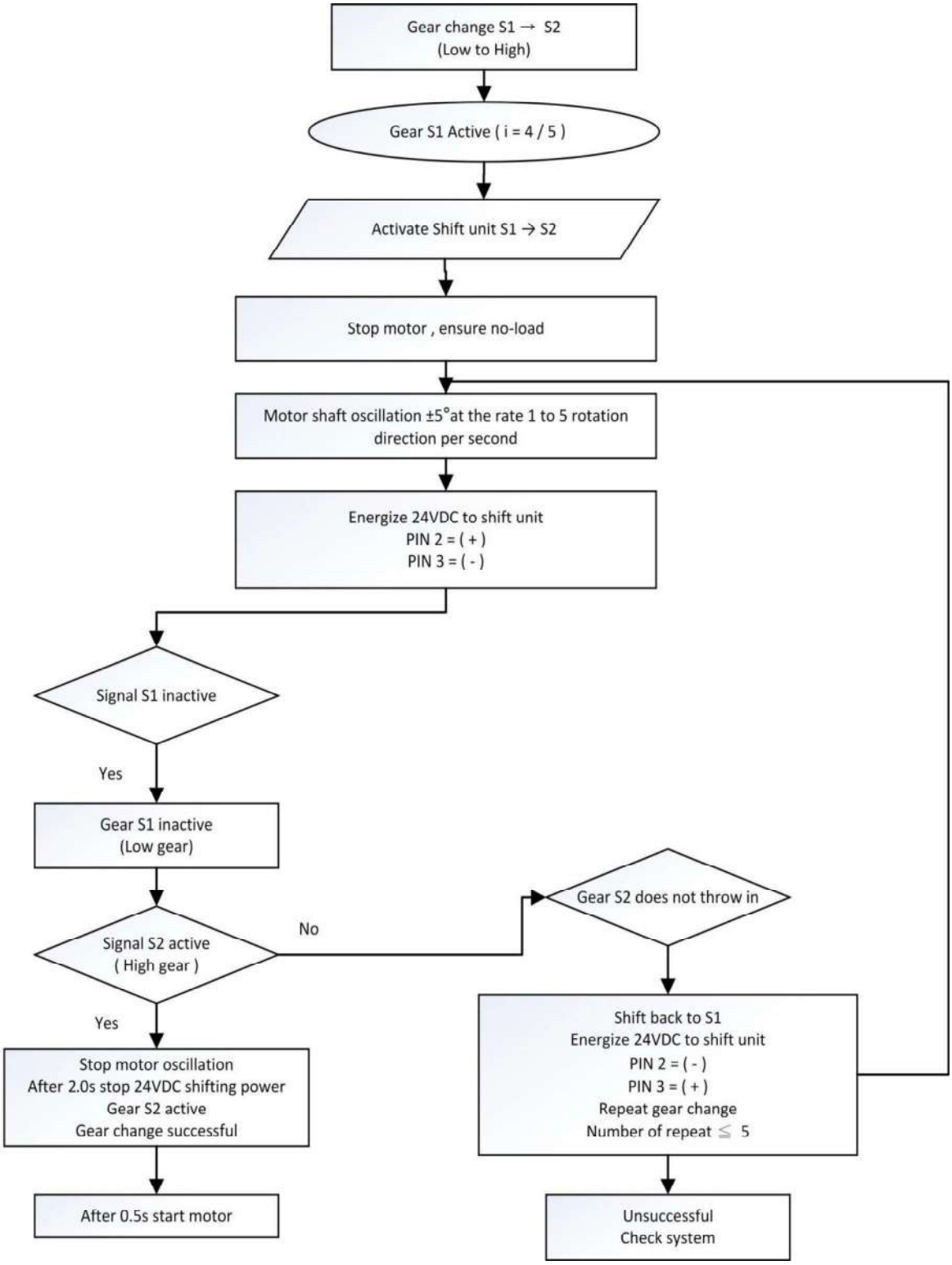


The shifter of gearbox is driven by 24V DC motor.

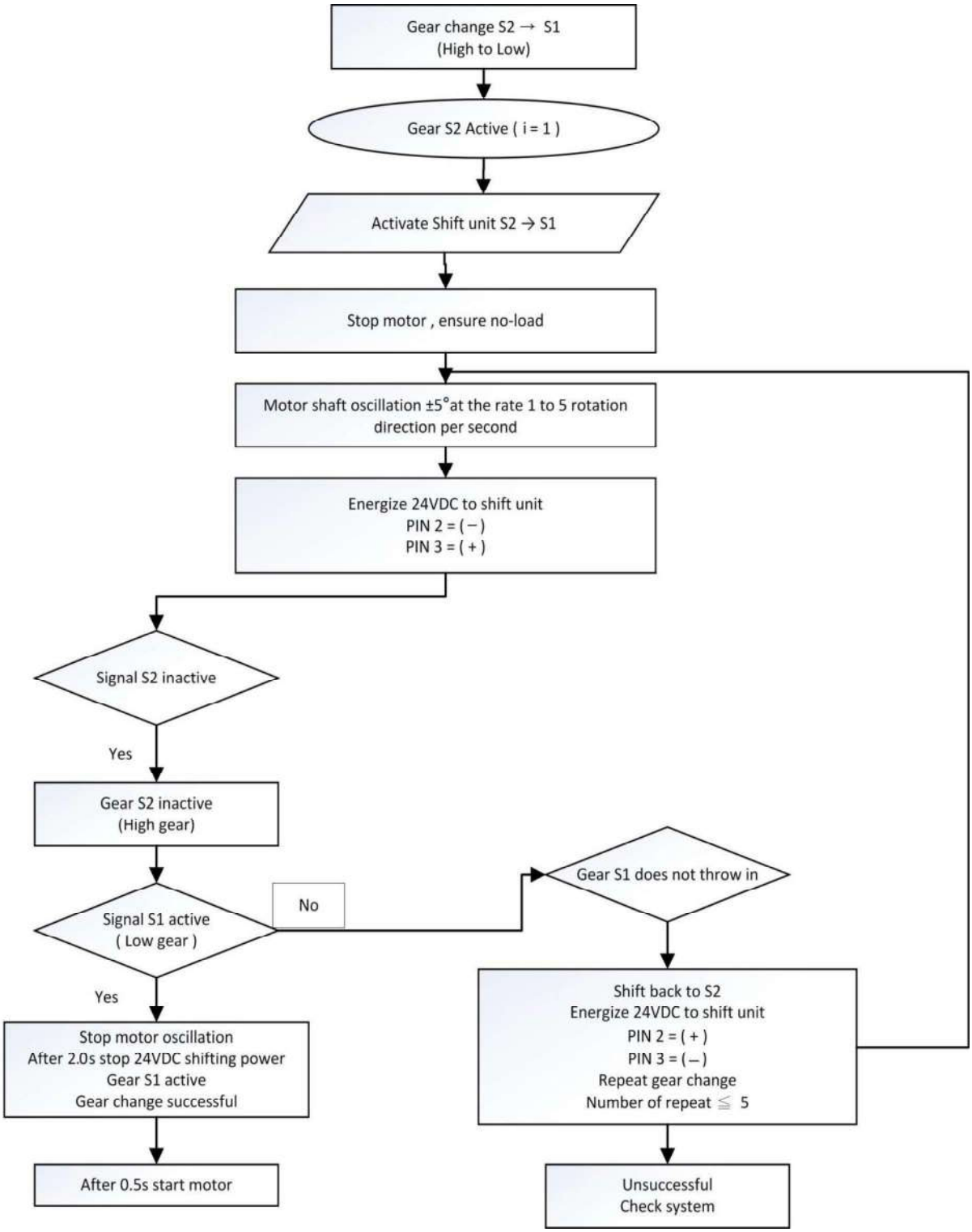
plug configuration Harting Han8U with Neutral position		
	cable color	2G600 / 2G800
Pin 1	brown	grounding housing
Pin 2	black	motor - ; - 24V DC ; min. 2.5A
Pin 3	red	motor + ; + 24V DC ; min. 2.5A
Pin 4	green	signal S1- Position
Pin 5	blue	power supply micro switch ; 24V DC ; max.1.5A
Pin 6	white	signal S2- Position
Pin 7	yellow	signal N- Position (closer)
Pin 8	grey	micro switch

3.7 Shift logic

S1 → S2 (Low gear to High gear)



S2→S1 (High gear to Low gear)



3.8 Neutral shift logic

To switch from S1 to neutral (N), pin 1 is positive and pin 2 negative.
To switch from S2 to N, the polarity must be inverted.

Gear change can only be done idleness (max. 5 rpm) and unencumbered.

Switching operation:
Status: gear stage S1:

- gear ratio i = 4.0 /5.0
- signal $_{S1}$ is active (low)

Status: gear stage S2:

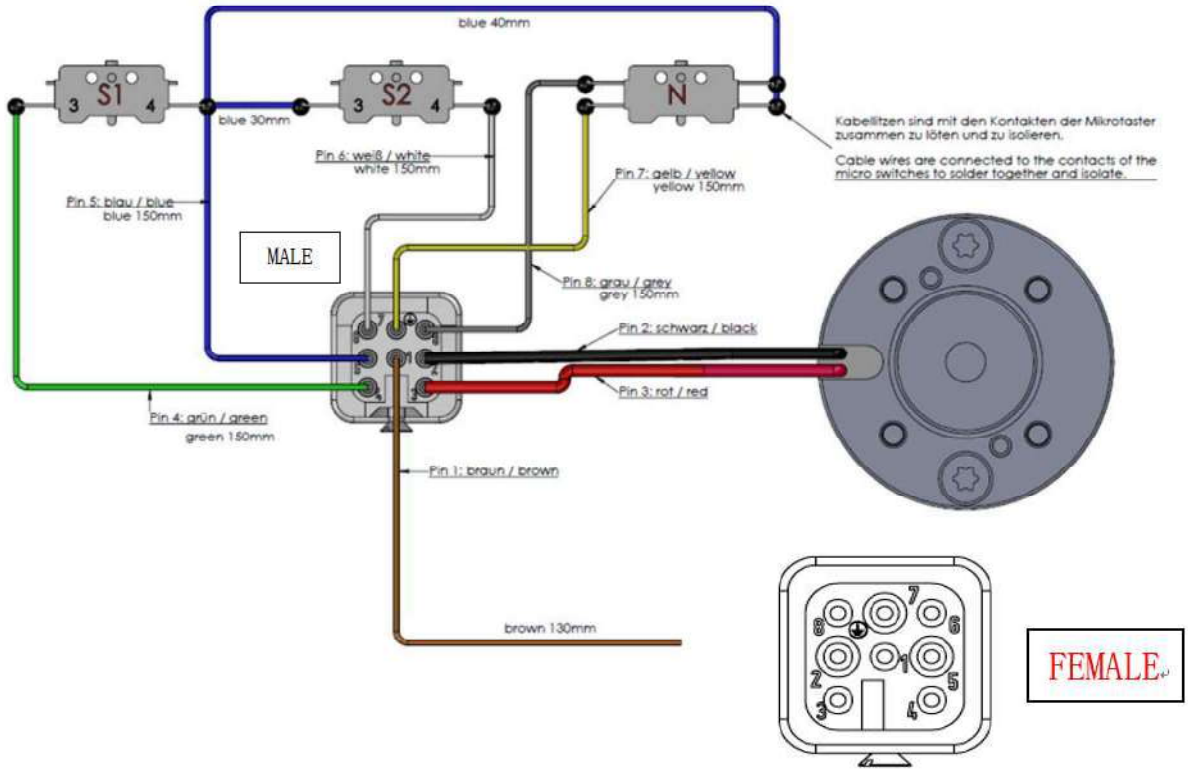
- gear ratio i = 1.0
- signal S2 active (high)

Status: neutral (N):

- input and output shaft are not keyed and can be pivoted
- signal N active (high)

With starting the gear change, input and output shaft have to be idleness (max. 5 rpm) and unencumbered. Alternatively, the main spindle motor can make the shaft oscillate ± 5°at a rate of 1 to 5 rotation directions per second.

Neutral shift logic



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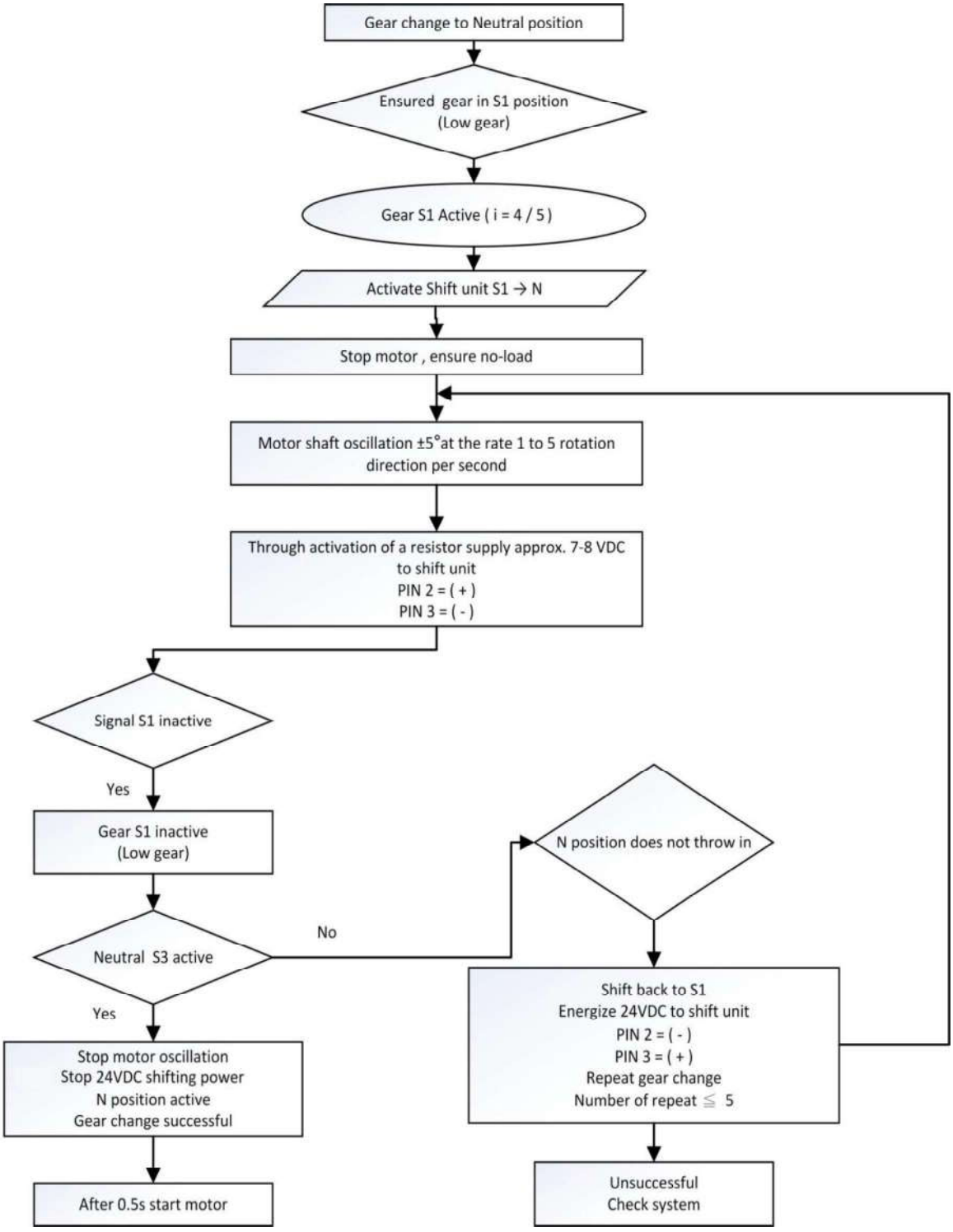
Pin 8	grey	micro switch

Shift logic -Neutral position



4 Installation and operation

4.1 Safety start

Please observe all the regulations about safety and accident prevention in the country or region. Only qualified personnel can carry out the installation and starting up.

Improper operation or use can cause serious injury or property loss.

GTP will not be responsible for the results due to wrong operation.

4.2 Before start

Please check the gearbox carefully and makesure no technical defect before installation.

Gearbox can be installed only under below conditions:

- ➢Technical data on the purchasing order is the same as the nameplate;
- ➢No damage on the gearbox;
- ➢Can rotate the gearbox shaft by hand;
- ➢Clean oil pipe, enough oil quantity and oil pressure;
- ➢All the electrical wires no damage.

4.3 Before operation

Must clean the antirust agent, dust or other contaminant(use standard agent). Keep the agent away from seal lip, it can damage the material!

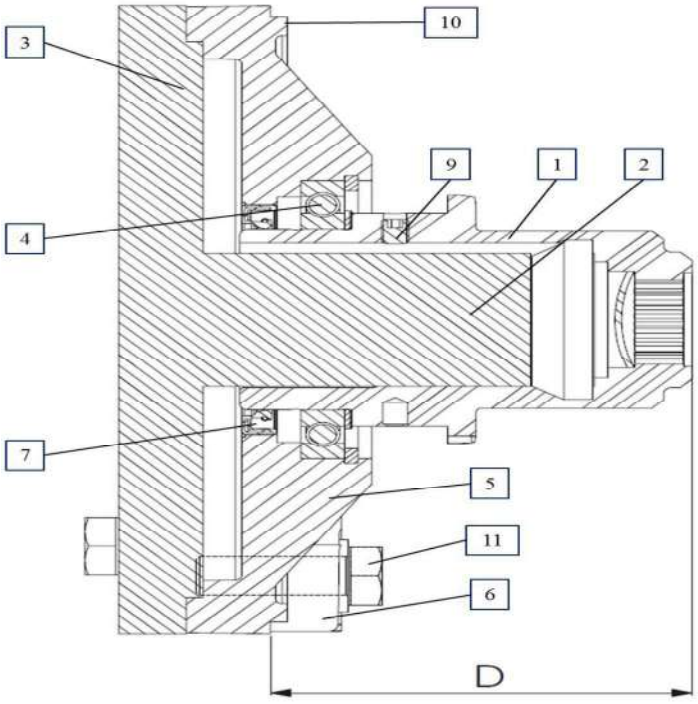
4.4 Input

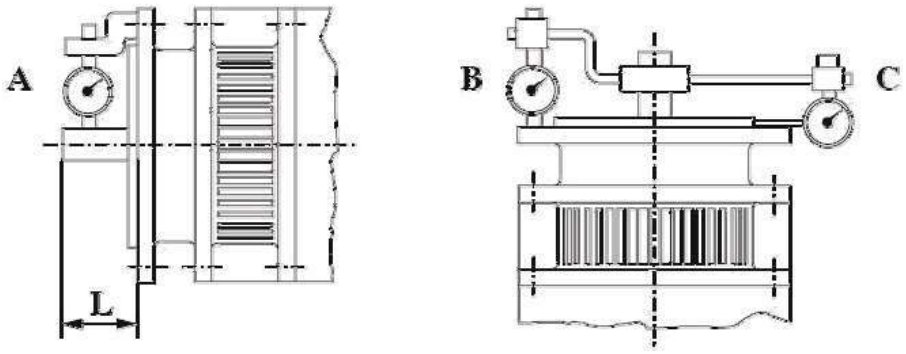
According to specific requirements GTP can provide different input versions.

4.4.1 Adaptation and assembling motor/gearbox

Different connection parts are used depending on the motor size
To ensure faultless function, the input hub must be mounted on the right position, therefore compliance with reference dimension “D” is necessary.

Gearbox 2G600 D value :175.3~175.5mm





Measurement of motor tolerance

Gearbox type	tolerance			
2G600	**A**	**B**	**C**	**L=140**
	0.025	0.063	0,063	±0,200
Tolerances *A,B,C* according to *DIN 42955R* Please note that the tolerance of the shaft length "L" is restricted in relation to the DIN standard!				

Motor tolerance

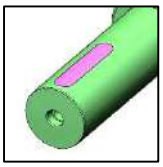
The tolerance for motor shaft length "L" must be conformed to the specification to ensure the normal operation of gearbox.

In case of oversize shaft, it must be machined to the correct tolerance

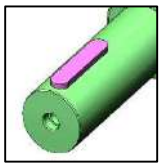
For undersize shaft, take shims to compensate it.

4.4.1.1 Balancing There are two balancing types for the motor and gearbox: half-key and full-key (DIN ISO 8821).

The hub is balanced without key. It must be ensured that the motor is balanced with full key. This is based on the original key.



Half-key balancing

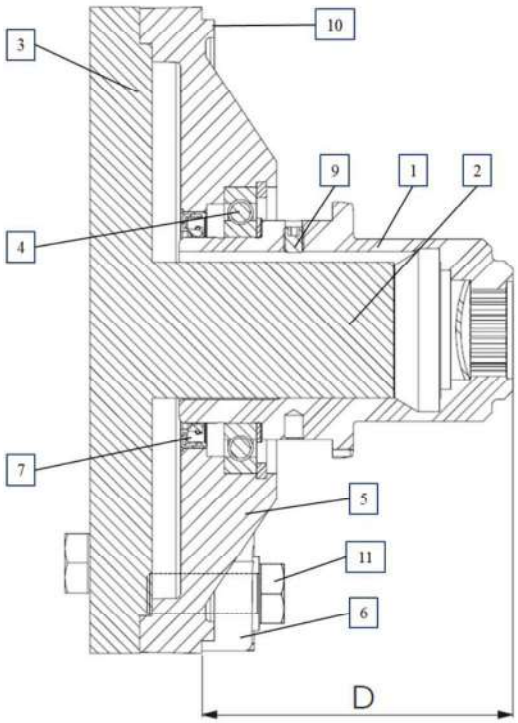


Full-key balancing

Motor output shafts with standard fitted key

Motor shaft diameter	Fitted key	Fitted key length
60 mm	A18x11	125mm
80 mm	A22x14	150mm

4.4.1.2 Closed design with hub and shaft seal



2G600 standard version is closed, because different motor types have different center heights, therefore, using different adapter plate(5) with seal(7) is necessary.

The reference dimension "D" is important for gearbox operating. D value is 175.3~175.5mm

Hub (1) and adapter plate (5) are not fixed with gearbox while transportation. Before installation, please clean the fitting surface of motor flange(3), hub(1), adapter plate(5) and gearbox.
Refer to the page 23 to check the "A", "B" and "C" values, then apply grease to the motor shaft lightly.
Adapter plate(5) with seal(7) is pre-installed to the motor shaft, fix it by bolts, then install gearbox.

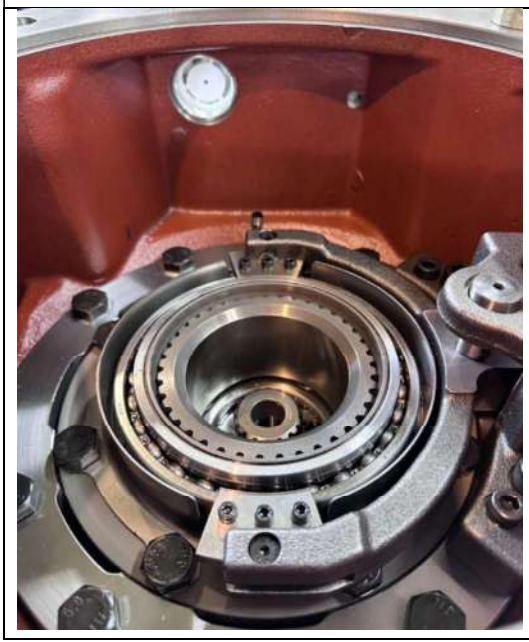
Apply grease to seal (7) and hub (1) completely before installation, check and make sure the seal(7) and its lip are in the correct position during installing processing.

After cleaning, heat the hub (1) opening side to about 120° C, then insert it to motor shaft until it cannot moved anymore.

The motor shaft will be damaged if the hub heating is not successful.

Recheck reference dimension “D” (as shown in Page. 22). Tighten the threaded pin (9) and secure it to prevent it from turning
Depending on the used specification, an O-ring or sealing compound is used to tighten the gearbox against the adapter plate and the adapter plate against the motor flange. Using the O-ring, it has to be coated with grease before being inserted into the seal groove.

Check the right position. Using sealing compound, observe manufacturers instructions.
Check the position of the gearbox shifting mechanism.
The sliding sleeve must be in gear position S1 low gear（i ≠1）.

Low gear position	High gear position
	

Take up the gearbox and place it onto the adapter plate.
Carefully bring the sun-hub-connection together when doing this.
This can be made easier by turning to the left and right at the gearbox output.
Gearbox housing, adapter plate and motor are bolted together using four or eight bolts, quality 8.8 or higher.

2G600 HUB spacer thickness calculation

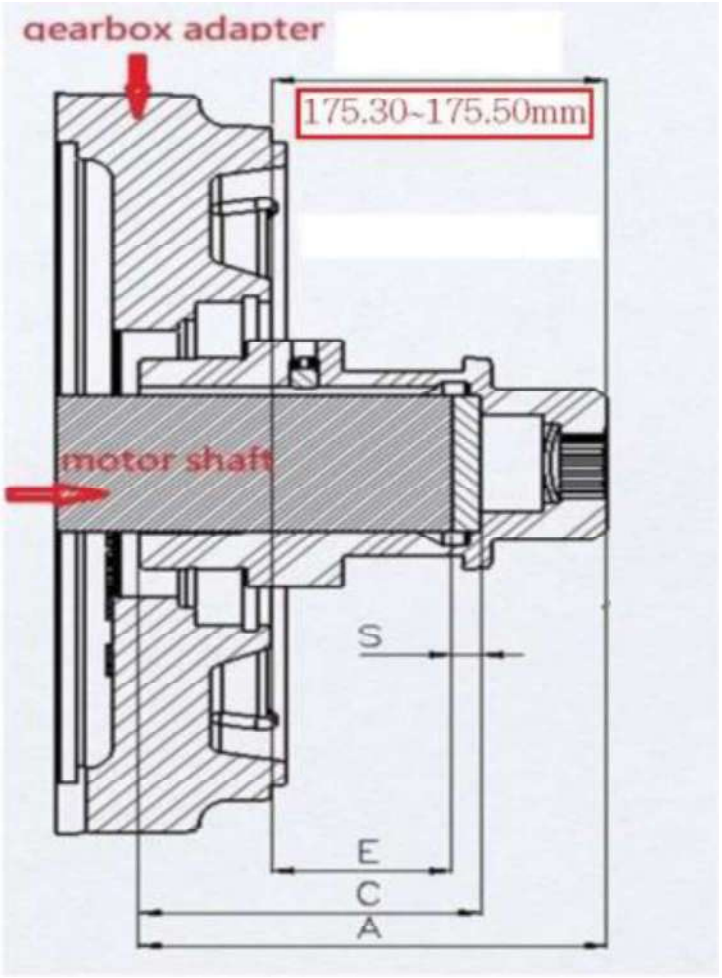
A = HUB length
C = HUB bore depth
S = spacer thickness

Step :

1. measuring A value
2. meaduring C value
3. mounting adapter plate to motor flange
4. measuring adapter to motor shaft end be E
5. calculating the spacer thickness

$$S= 175.4 - (A-C+E)$$

6. Insert the spacers into HUB , heat HUB , mount the heated HUB onto motor shaft
7. Checking the D value,it must be between 175.30 ~ 175.50mm

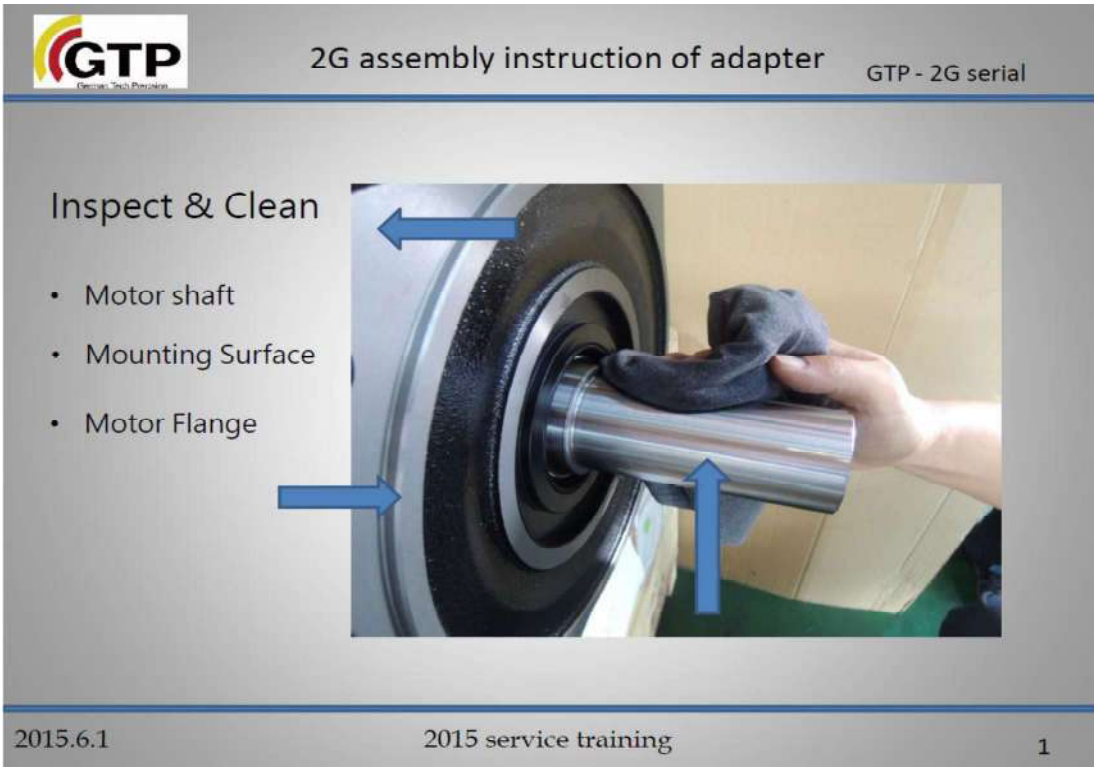


4.4.2 Pulley drive input(flange input)

Flange input is a special version and connected with pulley drive to the motor shaft. The pulley must be in the center of the outer diameter of the input flange, bolts tightening according to specified torque for friction engagement and fixing.
According to VDI Directive 2060, pulley drive should be balanced in quality 6.3 to ensure lower vibration operating.

Tighten the belts with specified tensioning force to avoid overload on bearing. The belt stress must be equally between the bearings.

4.4.3 2G assembly instruction for adapter



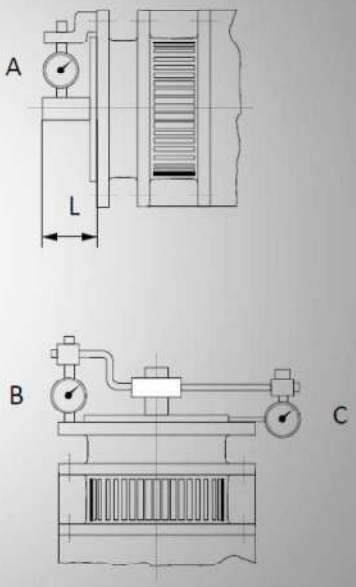
2G assembly instruction of adapter

GTP - 2G serial

- Axial runout , radial runout , length tolerance
- Motor mounting flange :

Type	Tolerance (mm)			
	A	B	C	L
2G250 / 2G300	0.025	0.063	0.063	- 0.200

Tolerance A , B , C to DIN 42955R please note that
The tolerance of the motor shaft length L is restricted
In relation on the DIN standard .



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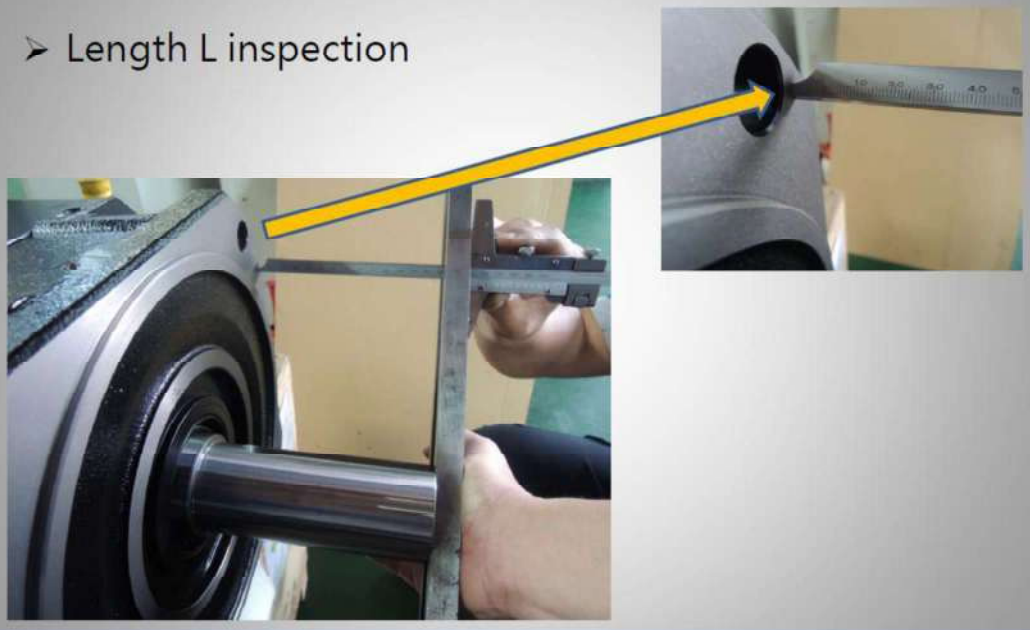
2G assembly instruction of adapter

GTP - 2G serial

➢ Length L inspection



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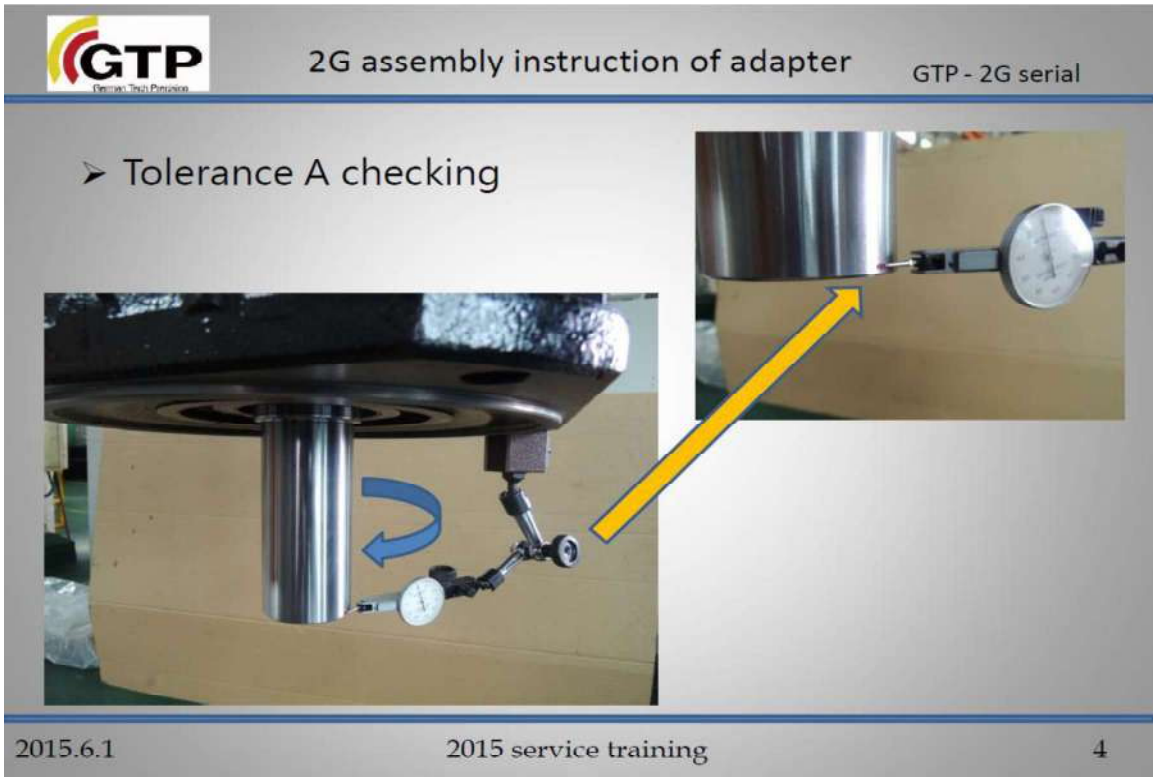
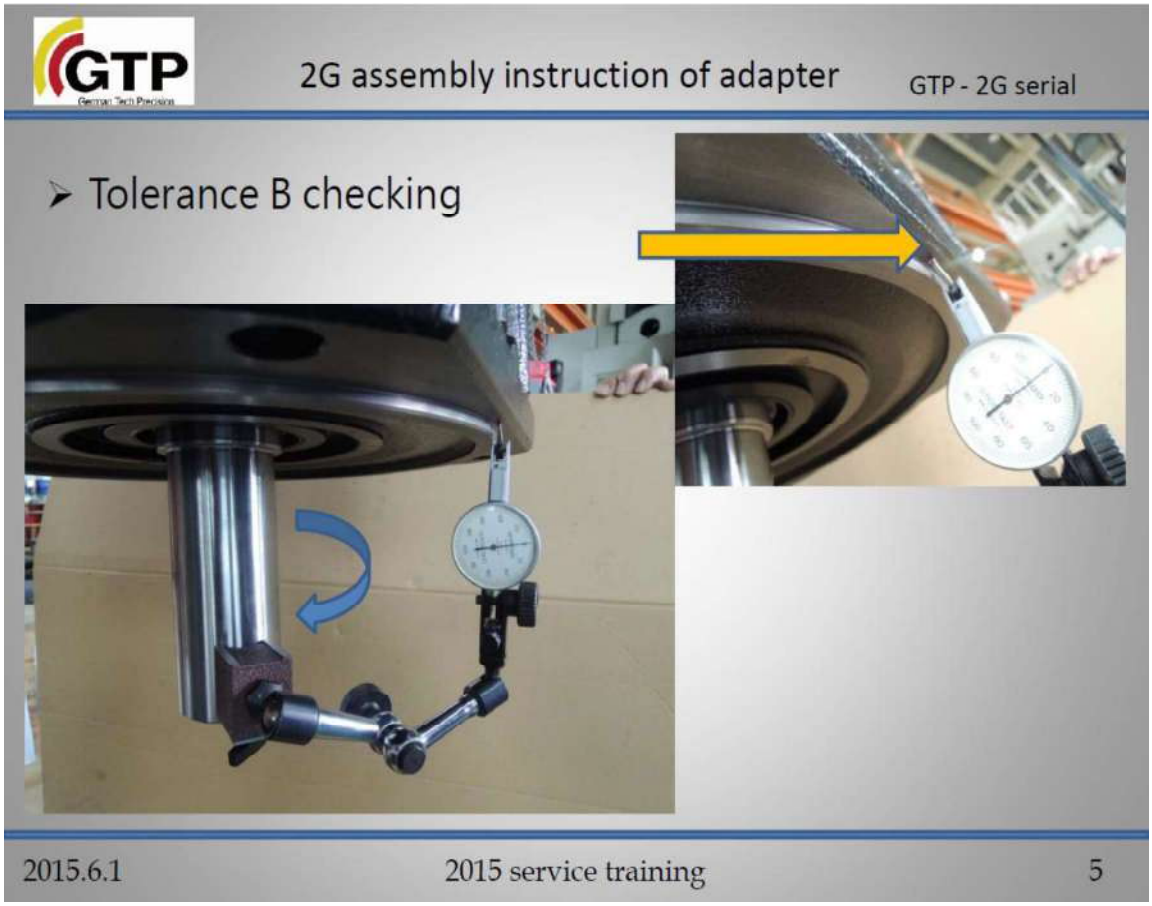

2G assembly instruction of adapter
GTP - 2G serial
Tolerance A checking
2015.6.1
2015 service training
4


2G assembly instruction of adapter
GTP - 2G serial
Tolerance B checking
2015.6.1
2015 service training
5

2G assembly instruction of adapter

GTP - 2G serial

- Tolerance C checking

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2G assembly instruction of adapter

GTP - 2G serial

- Clean inner of HUB & adapter surface

2015.6.1 2015 service training 7

2G assembly instruction of adapter

GTP - 2G serial

- Lubricate the motor shaft Surface with high performance grease for protection .

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2G assembly instruction of adapter

GTP - 2G serial

- Inspect thread making sure that everything is dry & clean .

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2G assembly instruction of adapter

GTP - 2G serial

- Heat HUB to 120℃
- The warm up process Can be done inside of HUB

Attention :
No direct to heat on the seal

2015.6.1 2015 service training 10

2G assembly instruction of adapter

GTP - 2G serial

- HUB key way level at The motor key .

2015.6.1 2015 service training 11

2G assembly instruction of adapter GTP - 2G serial

- To assemble adapter To the motor shaft .
- Push only on the HUB not on the plate .

2015.6.1 2015 service training 12

2G assembly instruction of adapter GTP - 2G serial

- To reach correct & position Tap gently with plastic hammer.
- No space between Adapter & motor plate .

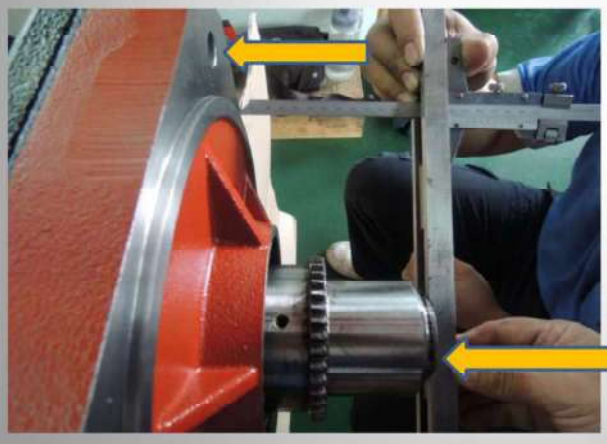
2G assembly instruction of adapter GTP - 2G serial

- When assembled , tighten screw Using Loctite 270 .
- Torque to 23Nm .

2015.6.1 2015 service training 14

2G assembly instruction of adapter GTP - 2G serial

To obtain correct HUB position , measurement D
Measure the HUB surface to adapter surface .
Measurement is 175.5-0.2mm



2015.6.1 2015 service training 15

4.5 Output

GTP two-speed gearbox 2G600 has two kinds of output versions.

4.5.1 Pulley output (standard / long output)

Pulley must be fixed at the center of flange (tolerance k6) outer diameter, fixing bolts tighten according to tightening torque.

The length of bolt shall be calculated to avoid excessive contact with the output shaft cover

Balanced level is 6.3 to ensure low vibration running

When strain the belt, please be aware of the maximum tension to avoid bearing overload. Belt stress must be evenly between the two bearings of output shaft.

4.5.2 Direct shaft output (inline / gear output)

Please pay attention on balancing method while useing direct shaft output, Gearbox output shaft is full-key balancing when it is delivered.

4.6 Electrical connection, shifting

The gearbox is electrically connected using the supplied 8pole Harting connector (HAN 8 U).

Shift unit Technical data：

Power: 120W

Voltage: 24 V DC ± 10%

Current: 5 A

Required cable cross-sectional diameter: 1.5 mm².

The 24 V DC connection voltage and 5 A power consumption must be assured on the shift unit connector. Losses due to cable length and transition resistors must be taken into account.
We recommend using a separate power supply to assure the stability of power.

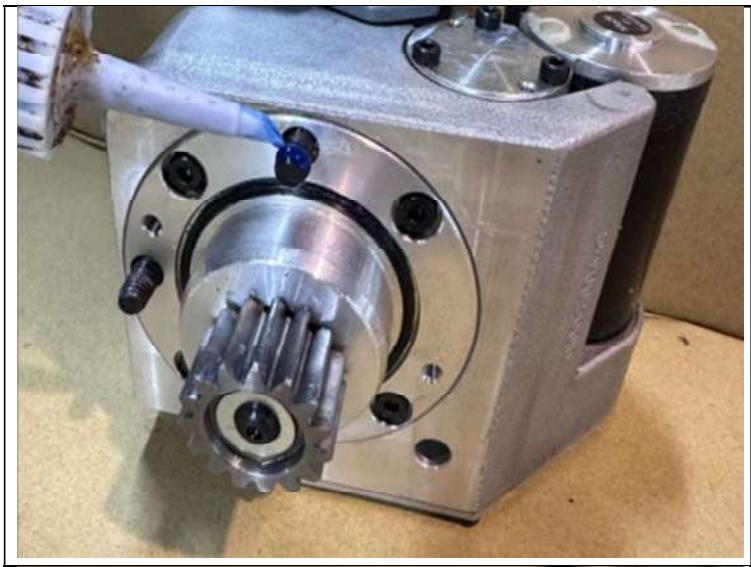
4.7 Shifter installtion

Don’t energize the shifter before installing the gearbox.

Before installing or removing the shifter, please ensure that the gearbox is in low gear.

1. Install the O-ring
   Before installing the O-rings, please apply grease to the O-ring to ensure it adheres better to the shifter.

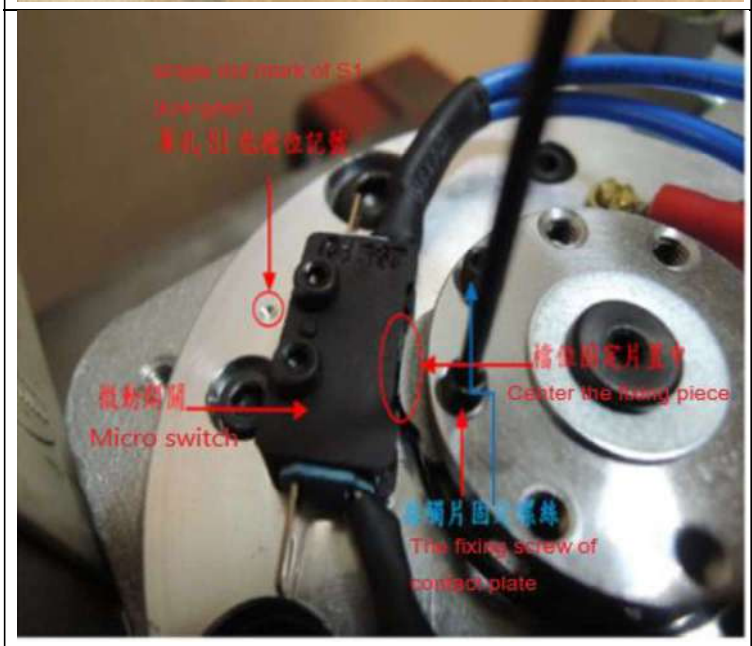
When installing， please make sure that did not press to the O-ring



2. Tighten the screws for the shifter, securing 2 pieces in place (do not apply thread locker yet).

   Then, apply Loctite 243 to the final screw and secure it.

   After completing this, remove the 2 positioned screws, apply thread locker, and then tighten them again.

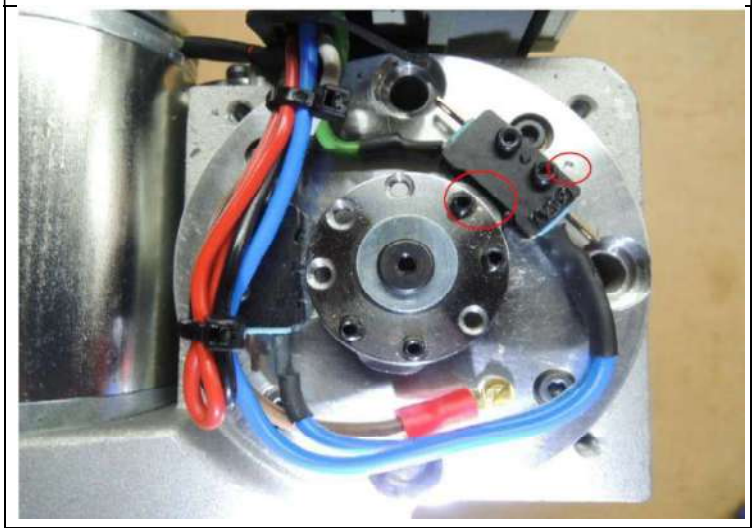


3. S1 gear position micro switch adjustment

   Using the shift control box to set the gear to high gear and place the gear contact piece into the S1 low gear micro switch.

   Adjust the contact piece to ensure it is centered with the microswitch

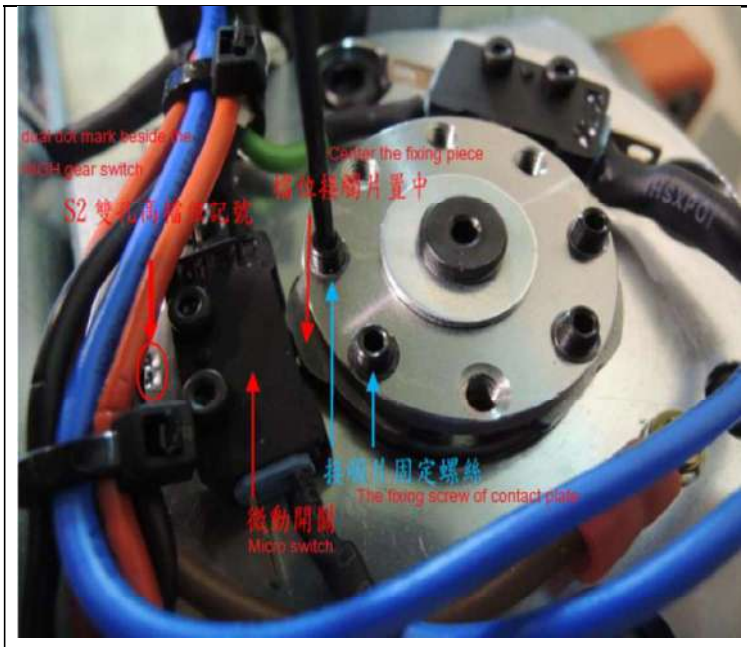
   After applying Loctite 243 to the M3x6 screws (2 pcs) for the contact piece, tighten and secure the screws.



S1 low gear position adjustment completed

There are a mark beside of both switch

There are a mark beside of both switch

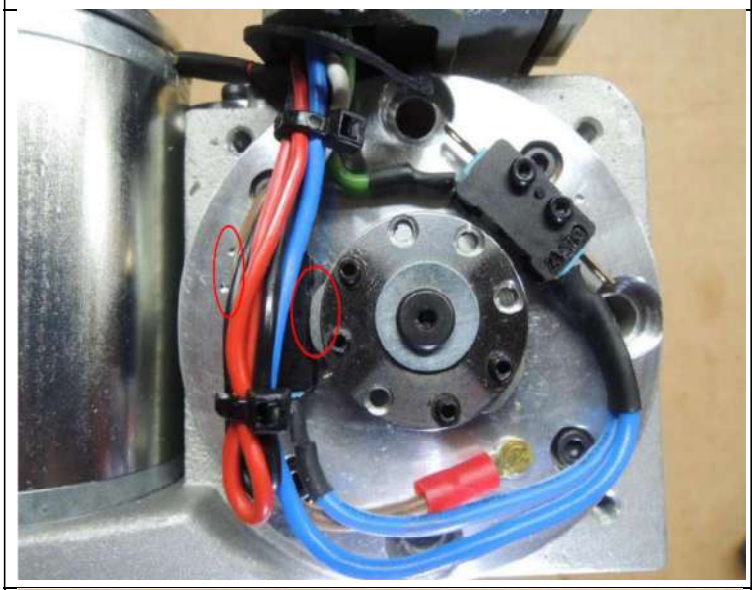


4. S2 gear position micro switch adjustment

Using the shift control box to set the gear to high gear and place the gear contact piece into the S2 high gear micro switch.

Adjust the contact piece to ensure it is centered with the micro switch

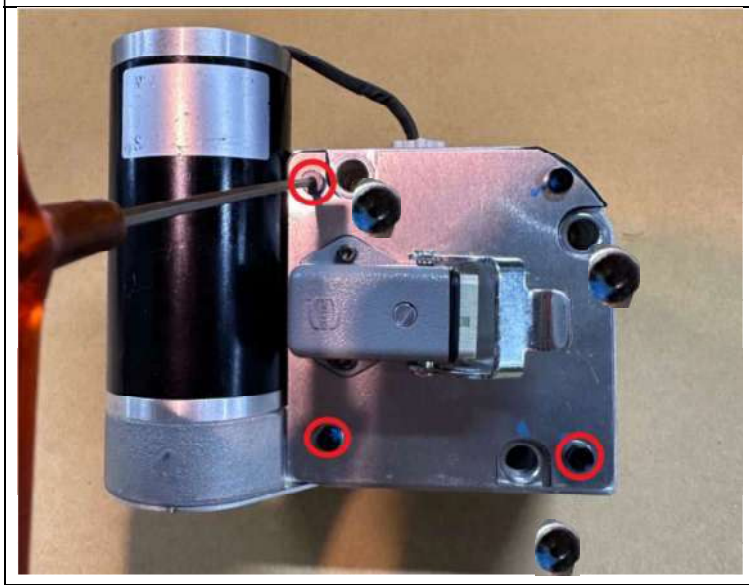
After applying Loctite 243 to the M3x6 screws (2 pcs) for the contact piece, tighten and secure the screws.



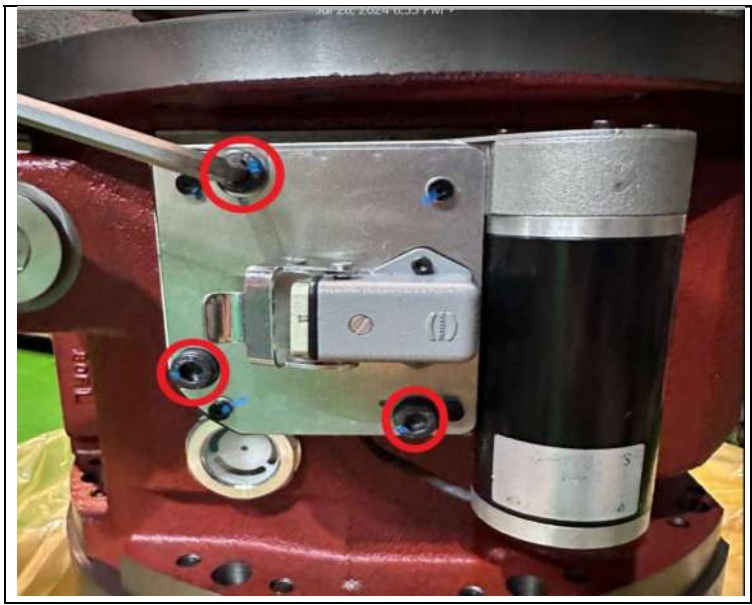
S2 high gear position adjustment completed

There are a mark beside of both switch

Dual dot mark beside the high gear switch



5. Use the hex key 2.5mm to tighten the 3 screws on the external cover of the shifter.

	6. use a torque wrench to apply torque. **torque :23Nm**

4.8 Installation

Installation position of GTP two-speed gearbox 2G600 is B5/V1/V3 。

Shift unit can be located on the left side, right side or top of the gearbox. The breather outlet must always be at the top, regardless of the installation position.

When install the motor onto the gearbox, support B side of the motor to reduce the vibration. When assembly make sure no blockage on the fan. Oil is out of supply scope. Before starting the gearbox, please assure enough oil quantity and oil pressure.

Input flange, output flange and output shaft rotate at a very high speed, must provide proper protection cover, otherwise there will be danger of injury!

4.9 Operation

Gearbox has to be checked about function. When check the function, need test the gearbox at both of the directions and ratios. Shift unit also need to be tested.

5 Inspection and maintenance

Frequency	Content
Every day:	- check the oil channels and oil control system
Every week:	- check the oil level of gearbox - check the oil quantity(visually) - check the filter - check the leakage of the gearbox
After 2000 working hours or every six months	- change the oil - check the oil channel and control system

Intervals for check and maintenance must be kept.

It may cause damage on the bearing or gear if don't comply with above description about check and maintenance.

Check and maintenance can be only carried out when the gearbox cool down. Hot oil may cause injury.

6 Fault finding and Tips

Fault	Cause of fault	Tips
Gearbox is loud, running noise	a) engaging/friction noise: bearing damage	a) contact GTP service.
	b) Knocking noise: drive mechanism is asymmetric.	b) contact GTP service.
	c) Rotating noise: wrong installation of output shaft.	c) Mount the output shaft onto the spindle correctly, careful about second damage.
Abnormal, irregular noise	Foreign object in the oil.	- Check the oil - stop the gearbox and contact GTP service.
Oil leakage at		
a) gear cover	a) rubber seal of the gear cover has a leakage	a) Tighten the screw between gear cover and gear, if still leakage please contact GTP service.
b) sealing	b) sealing defect	b) Contact GTP service.
	c)oil cannot return to oil cooler.	c) Check the oil quantity and remove the foreign object, if still leakage please contact
Motor or input shaft rotate, output shaft cannot rotate.	a) Connection between shaft and hub is interrupted.	Return the gearbox to the manufacturer.

6.1 Gearbox - disassemble

- Stop the machine
- Stop the power supply
- Disconnect the electrical plug
- Drain the gearbox oil and disconnect the gearbox oil pipes
- Remove the bolts (11)
- Pull the gearbox (6) off the adapter plate (5) and hub (1)

Hub:

- Screw off the pin(9)
- Using the three am puller and remove aid(12) to pull off the hub until it is separated from motor shaft.

After disassembly renew the hub seal disc and o-ring
Before installing clean and coat the sealing edge with liquid seal.