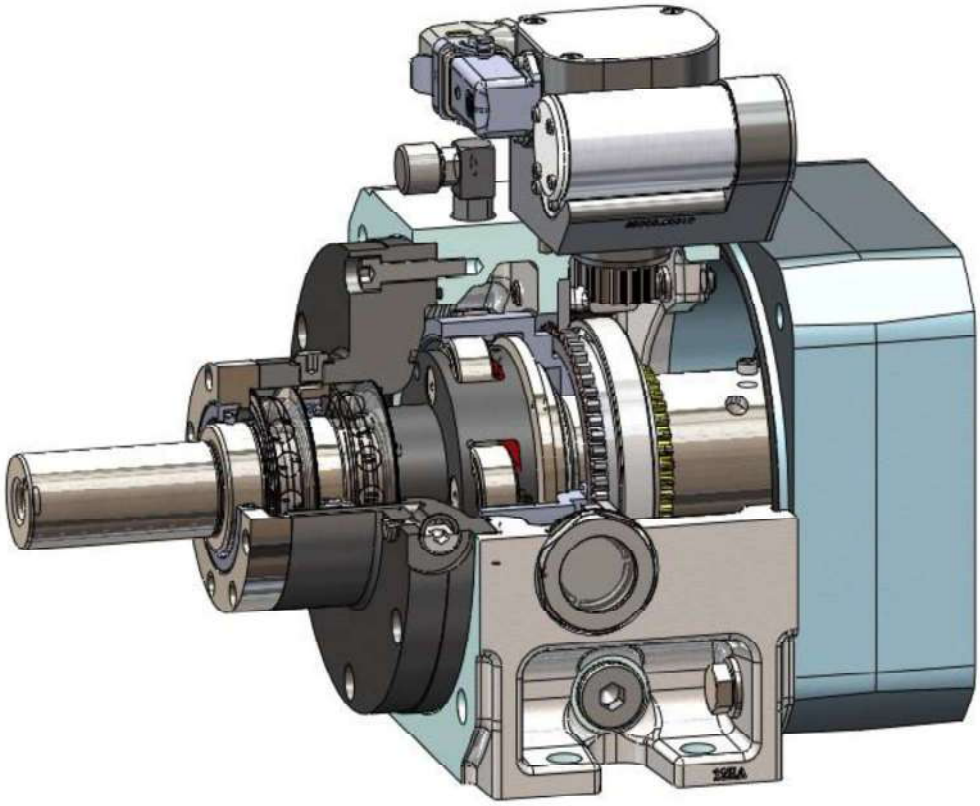
German Tech Precision Manufacturing Co., Ltd

Installation and Operation Instructions
(manual)

For two-speed gearbox

2G120 / 2G121



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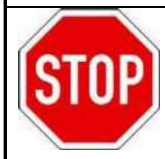
1 Important Notes

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 delivery;
- ➢ 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 can 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.

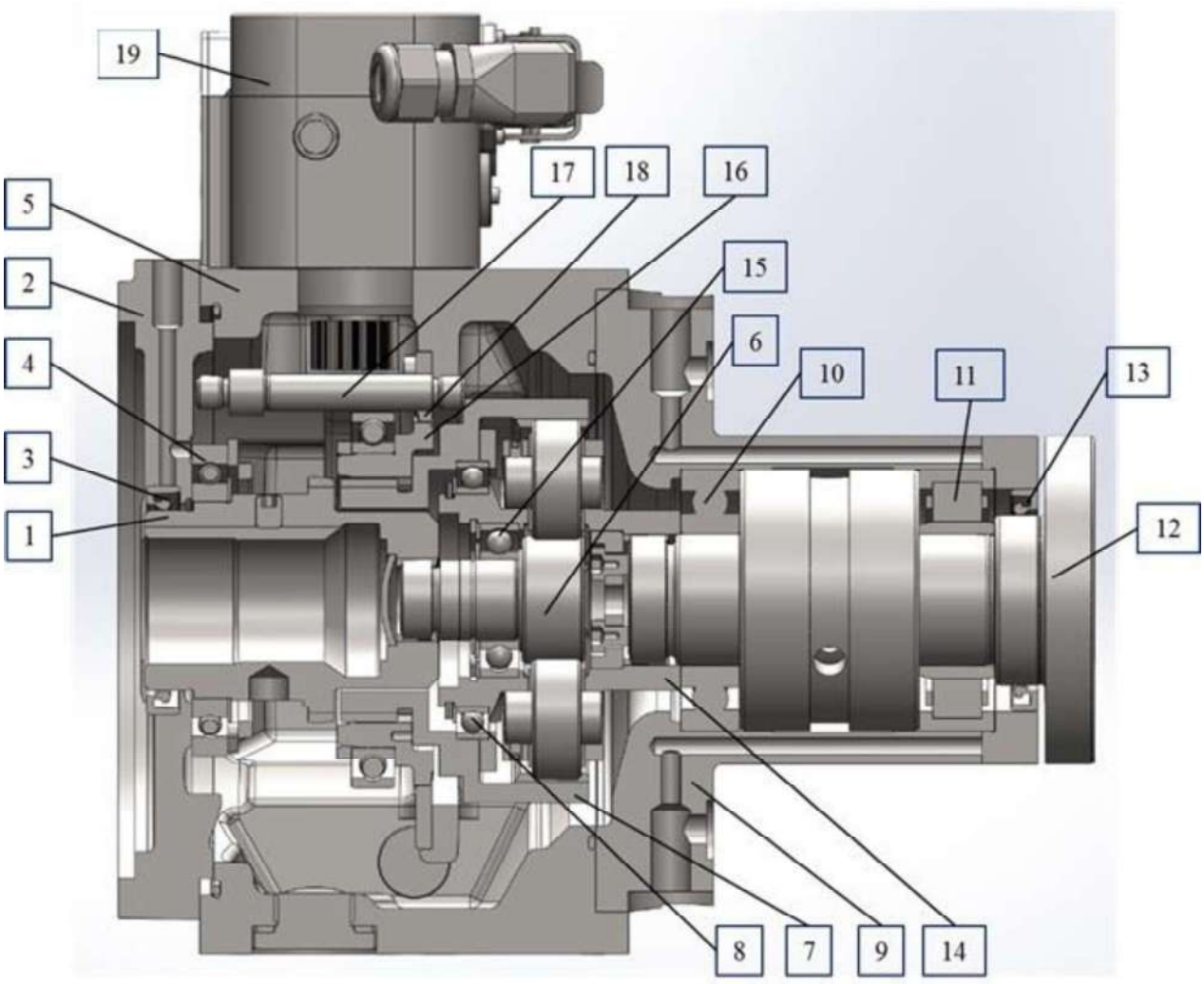
With different installation positions the gearbox can be used in Vertical Lathe and Horizontal B5, Vertical Machining center V1 or V3.

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

Before starting the gearbox, confirm oil connect correctly to avoid damage, and make sure lubrication system is working.

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	
5.Gearbox housing		15.sun gear bearing	

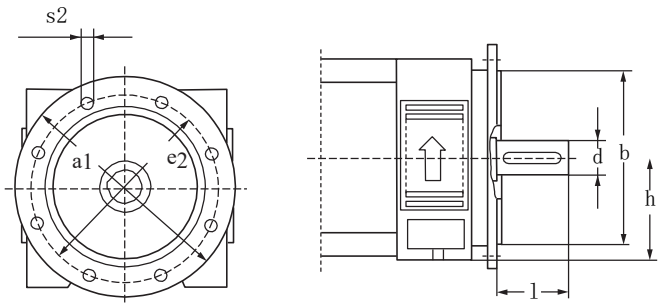


3.1 Technical data

Type	2G120	2G121
Nominal power	Max. 19kW	Max. 19kW
Nominal speed	1500rpm	1500rpm
Nominal input torque	Max. 120Nm	Max. 120Nm
Max. input speed i≠1	8000rpm	8000rpm
Max. input speed i=1	12000rpm	12000rpm
Max. output torque i = 1.00 i = 4.00 i = 4.91	 120Nm 480Nm 589Nm	 120Nm 480Nm 589Nm
Weight	About 43kg	About 53kg
Motor dimension		
h	100	112
d	32/38/48	42/48
l	80-0.1	80-0.1
b	180	230
e2	215	350
a1	-	-
s2	14	14

Caution:

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

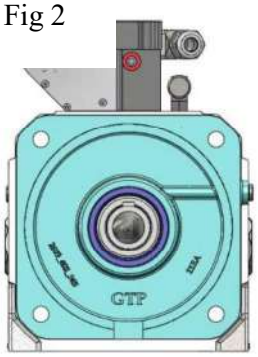


3.2 Installation position

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

Fig 1

Fig 2



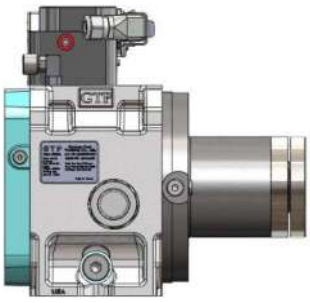
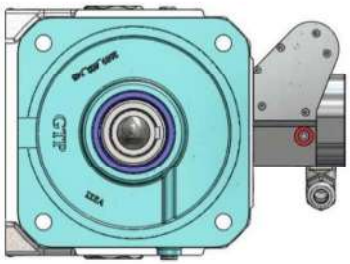


Fig 3 Horizontal B5 rotate 90°

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



Vertical (fig 4, fig5)

Fig 4 Vertical V1

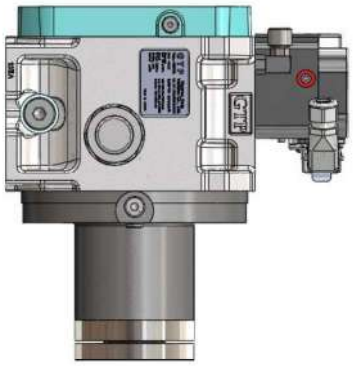
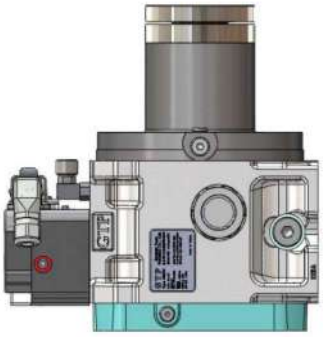


Fig 5 Vertical V3



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 2G120/2G121 is usable as below models:

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

Two sizes of motor: center height (AH): (100mm and 112 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

Inline output version

Inline CTS output version

Shift unit can be placed on the right or top of the gearbox.

3.4 Backlash

GTP two-speed gearbox 2G120 / 2G121 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 2G120/2G121, 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 gearbox.

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

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 total 2.5 liters / minute.

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

To maintain oil smooth run 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 quantity of the oil tank should be at least 10 times of requested circulating oil volume or 20 liters

GTP recommends that install flow meter and pressure gauge in the tank to avoid gearbox damage 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 rise in the gearbox.

During gearbox operation, sub tank oil level decreases due to foaming of the lubricating oil in the gearbox.

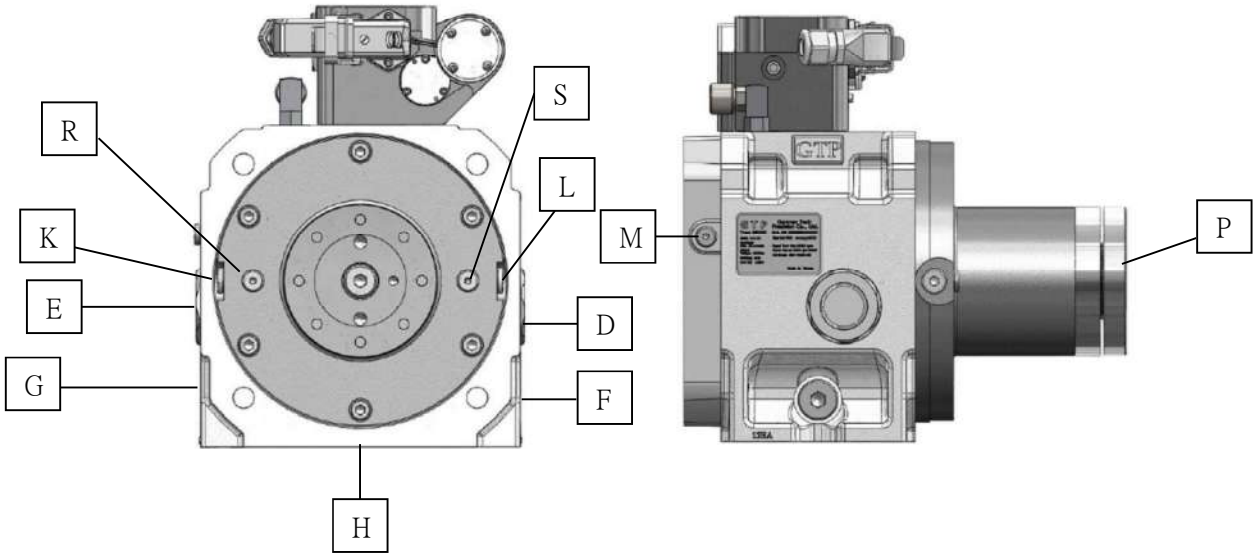
When the gear box oil flows back to the sub tank and there is latex-like liquid, due to the mixing of oil and air.

3.5.5 Lubricant

	Description	Application	Remarks
Gear box oil	HLP68 to ISO VG68	Splash lubrication (depending on installation position)	
	HLP46 to ISO VG46	Recirculating lubrication	Also for recirculating without lubrication heat exchanger
	HLP32 to ISO VG32	Recirculating lubrication with heat exchanger	
	HLP22 to ISO VG22	Recirculating lubrication with heat exchanger	

3.5.6 Ports and connections for initial fill/oil change

Installation Position	Inlet ports	Outlet ports
V1	M	L,K shaft output
		P flange output
V3	K,L	H
B5	K	G,F,H
B5 rotate	E,G	F,D



3.5.7 Ports connection at max. speed

Connecting K or R to an integral lube oil system is mandatory in applications with maximum speeds of 12000 rpm.
Furthermore, a gearbox oil cooler >0.3 kW and a circulating oil volume of >15 liters is required.

When using the gearbox at max. speed:
- Please make sure connect M and K (or L), oil quantity should be 3 liters/min, oil pressure should be 3bar.
- If space is enough for using K and L together as oil inlets, oil quantity should be 2.5 liters/min, oil pressure should be 2.5bar.

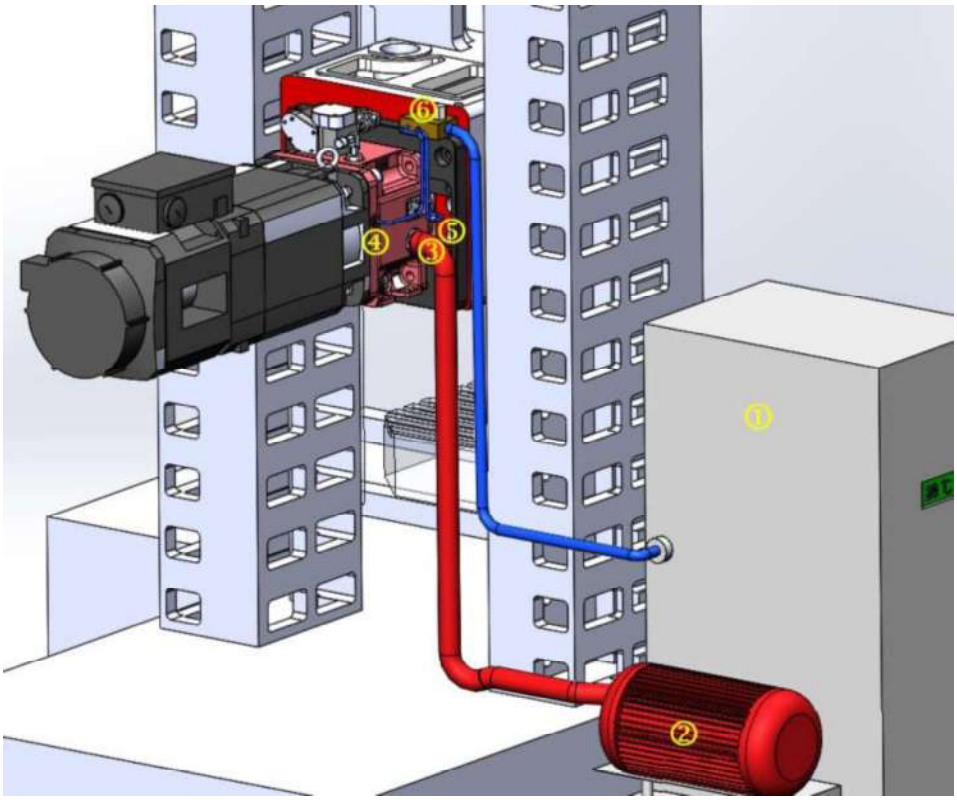
- All types include oil inlet K/R with internal lubrication hole.

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

Installation position	Inlet ports	Max. pressure	Outlet ports
V1/B5	**K or R**(1.5 dm^3/min) **M**(approx. 1.0 dm^3/min)	2.5 bar	D or E
V3	**K or R** (1.5 dm^3/min) **M**(1.0 dm^3/min)	2.5 bar	H
B5 rotate 90°	**K or R**(1.5 dm^3/min) **M**(1.0 dm^3/min)	2.5 bar	H

Oil circuit configuration diagram

1. Oil chiller
2. Pump
3. Oil out let E
4. Oil inlet M
5. Oil inlet K
6. Flow meter and pressure gauge

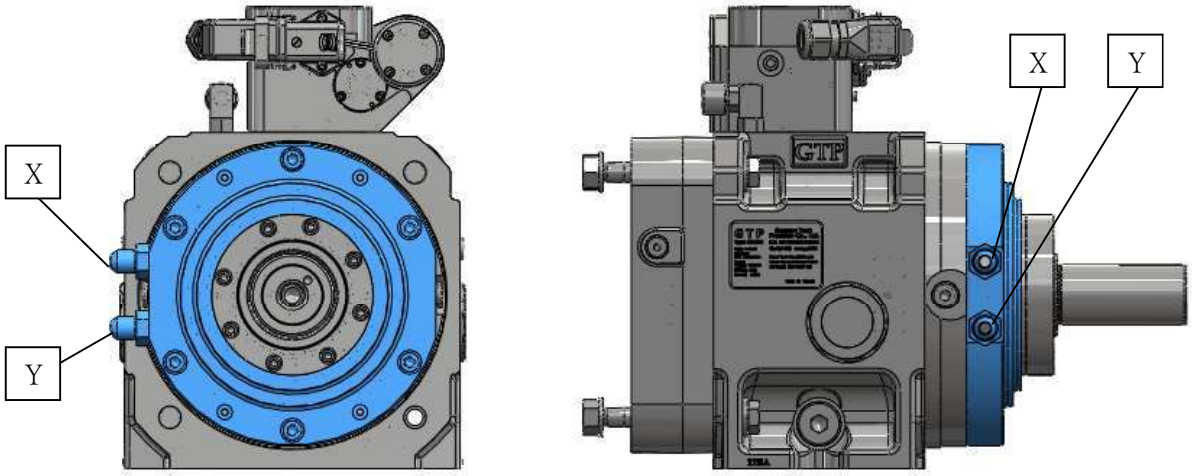


3.5.8 Gearbox with cooling jacket

The cooling jacket is installed in the recirculating lubrication system to assure additional temperature reduction. In order to achieve an optimal temperature development of the gearbox, we strongly recommend independent on recirculating lubrication system with the gearbox and cooling jacket.

When using the gearbox with cooling jacket:

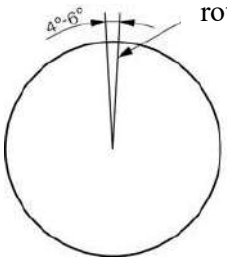
- Please connect X port as inlet, connect Y port as outlet, oil flow-rate suggest 2~5 liters/min and oil pressure is 2~ 3 bar.



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



rotary direction change

Speed [rpm]	Time [sec]	Angle [°/sec]
0. 25	3. 33	5
0. 50	1. 67	5
1. 00	0. 83	5
2. 00	0. 42	5
3. 00	0. 28	5
4. 00	0. 21	5
5. 00	0. 17	5

In general :

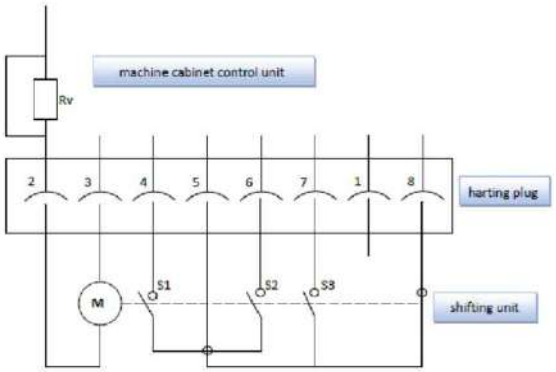
$n_{Mot} = 5°/s = 5° \times 60/min = 300°/min = 300/360\ rpm = 0.83\ rpm$

After the limit switch obtains signals from S1 (pin 4) and S2 (pin 6), it indicates that the gear shift has been completed and the motor power will be cut off.

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

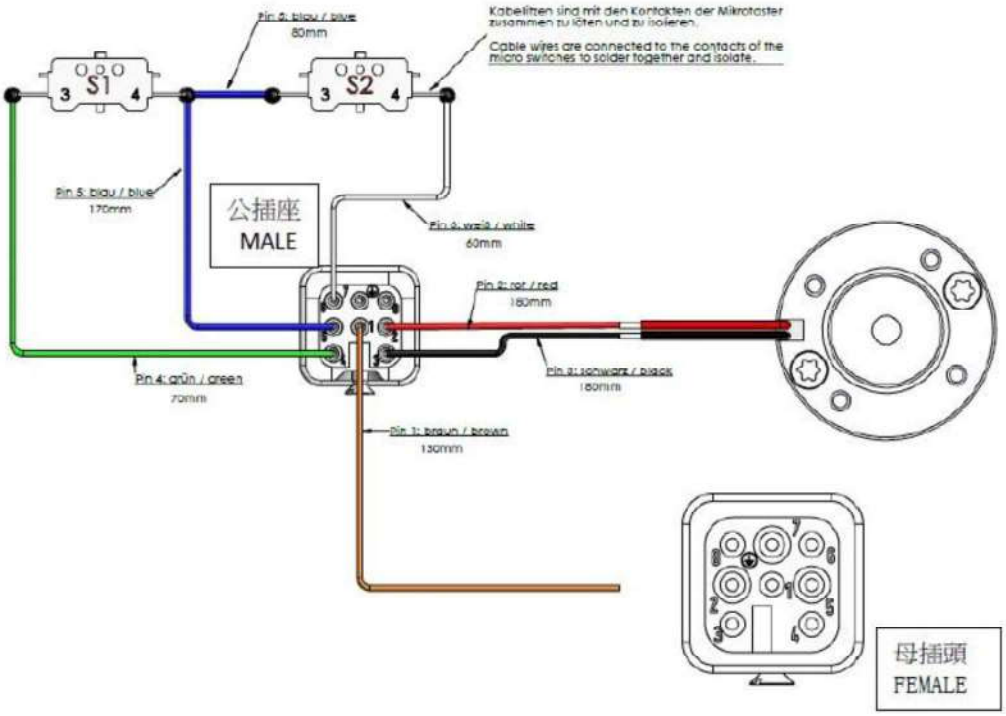
If the limit switches detect that a gear is no longer securely engaged, emergency shut-off must be initiated through the control system. Electromagnetic fields can falsify the limit position monitoring currents. This can be prevented by rerouting or shielding the circuit.

Diagram for shift unit with two positions:



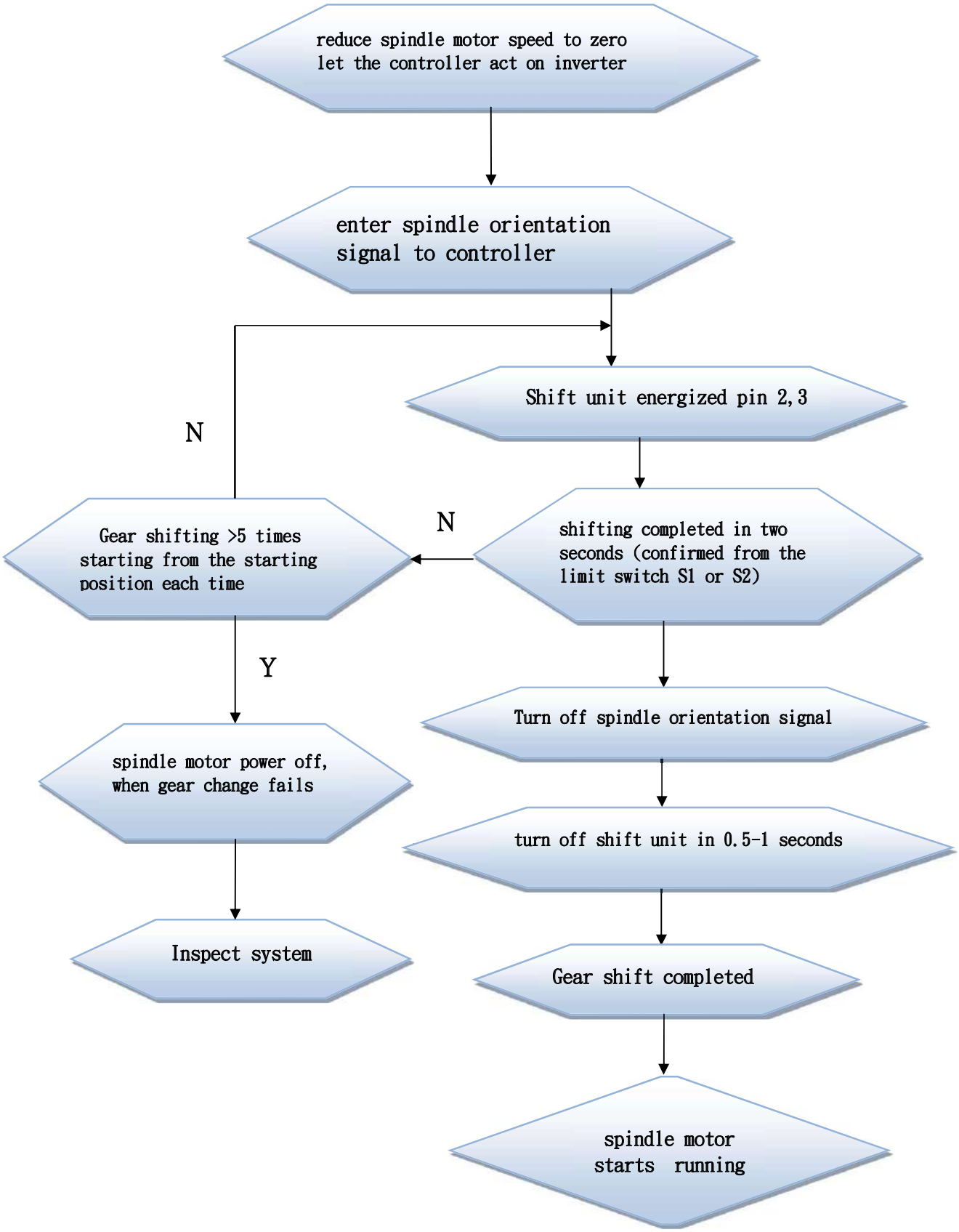
1st gear ==>e.g. 4:1

2nd gear ==> 1:1



Gearbox shift unit driven by 24V DC motor

3.7 Shift logic



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 match able with 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

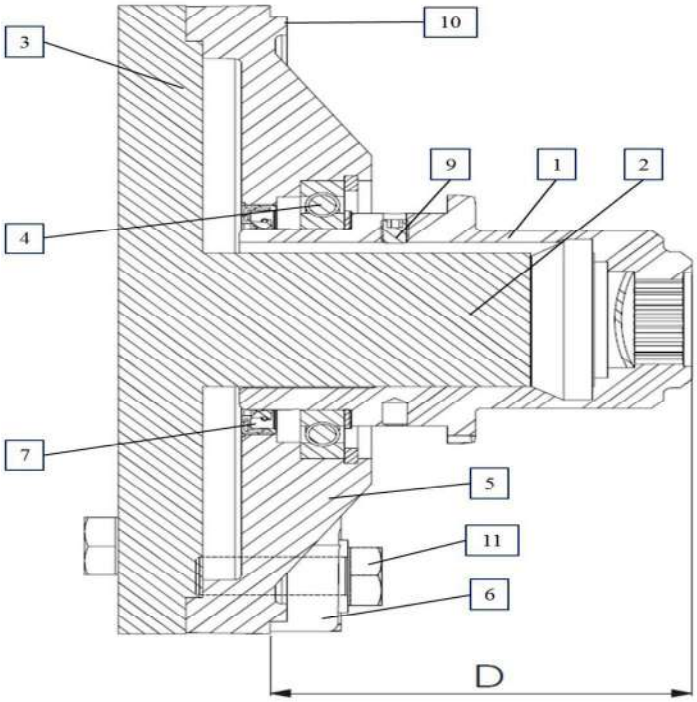
According to specific requirements GTP can provide different input versions.

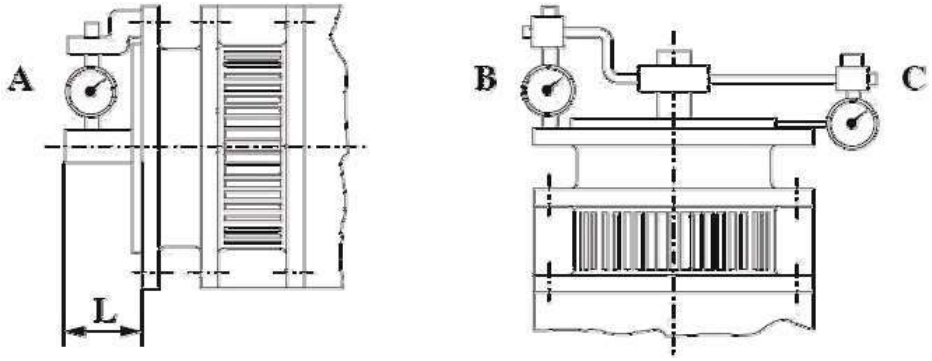
4.4.1 Adaptation and assembling motor/gearbox

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.

Gear box	D value (mm)
2G120	73-0.2
2G121	93-0.2


10
3
9
1
2
4
7
5
11
6
D



Measurement of motor tolerance

Gearbox type	tolerance			
2G120/2G121	**A**	**B**	**C**	**L=140**
	0.025	0.050	0,050	±0,100
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

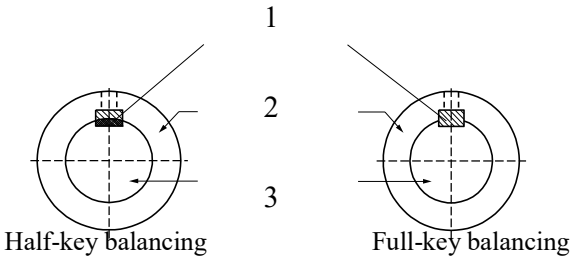
The tolerance for motor shaft length "L" must be conformed to the specification to ensure the normal operation of gearbox.

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: Semi-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.

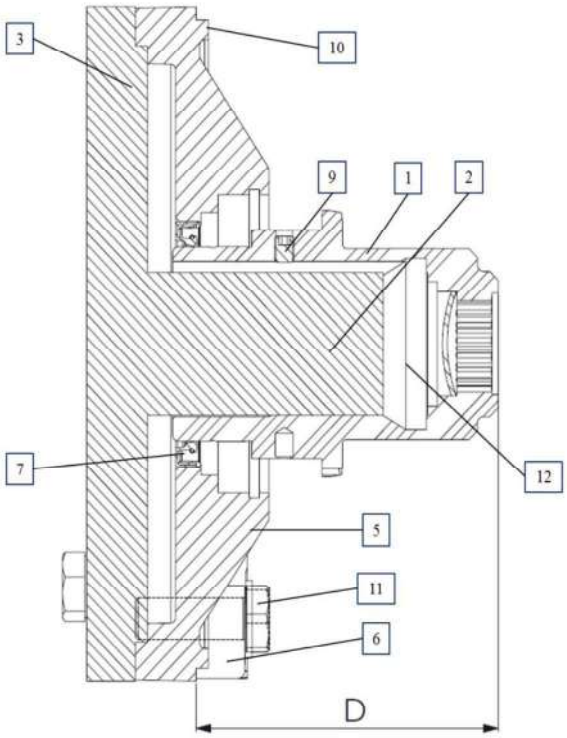


Motor output shafts with standard fitted key

Motor shaft diameter	Fitted key	Fitted key length
32/38 mm	A10x8	70 mm
42 mm	A12x8	90 mm
48 mm	A14x9	90 mm

4.4.1.2 Closed design

Closed design with shaft seal



2G120/121 standard version is closed, because different motor types have different center heights, therefore, using different adapter plate(5) with seal(7) is necessary.

Hub (1) and adapter plate (5) are not fixed with gearbox while delivery. Before installation, please clean the fitting surface of motor flange(3), hub(1), adapter plate(5) and gearbox.

Refer to the 4.4.1 to check the “A”, “B” and “C” values, then apply grease to the motor shaft lightly.

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

Confirm D value, if necessary change the thickness of shim (12).

Shim thickness calculate

2G120(HUB)shim thickness

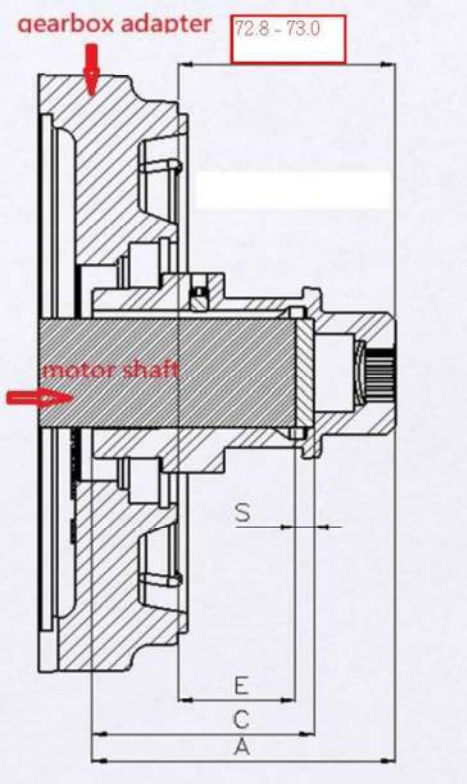
A = hub outer length
C = hub bore length
S = shim thickness

Step :

1. measure A value
2. measure C value
3. install adapter to motor
4. Measure the distance from adapter the motor shaft E value
5. calculate shim thickness S value

S= 73 - (A-C+E)

6. put shim into hub, heat hub and install it on motor shaft.



7. measure D value, standard 72.8～73.0mm

2G121(HUB) shim thickness

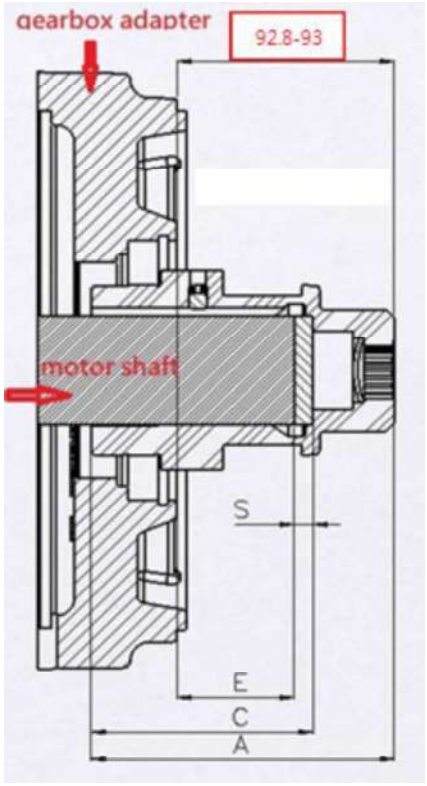
A = hub outer length
C = hub bore length
S = shim thickness

Stpe :

1. measure A value
2. measure C value
3. install adapter to motor
4. Measure the distance from adapter the motor shaft E value
5. calculate shim thickness S value

S= 93 - (A-C+E)

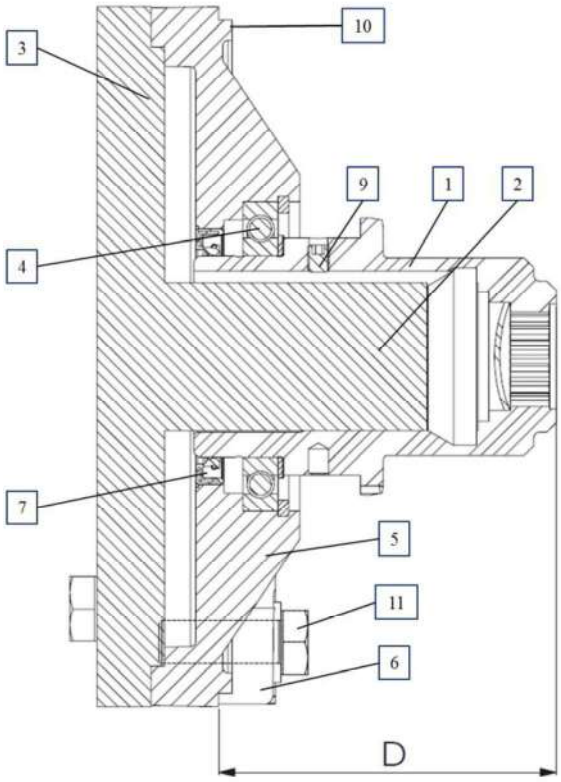
6. put shim into hub, heat hub and install it on motor shaft.



7. measure D value, standard 92.8～93.0mm

- The motor shaft will be damaged if the hub heating is not successful.
- Apply grease to seal and hub completely before installation, check and make sure the seal and its lip are in the correct position during installing processing.
-

4.4.1.3 Close design – with hub and seal



Install bearing (4) to avoid hub (1) displacement of the wheel hub. Dismantle hub (1) adapter (5) main housing (6), and clean the motor (3) and clean surfaces.

Refer to the 4.4.1 to check the “A”, “B” and “C” values, then apply grease to the motor shaft lightly.

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

Confirm D value, if necessary change the thickness of shim (12).

(The D value pre setting in factory)

- During assembly, the hub must be easily pushed to the bottom by hand until adapter plate conatct with flange, do not hit adapter plate. ◦
- confirmed adapter plate rotate freely after installation to avoid preload on the bearing.

4.4.2 Gearbox installation

The M8 set screw (9) must be screwed in and tightened at the parallel key with 23 Nm until firmly home. Make sure you coat the threaded pin with liquid seal before installing it.
Make sure that the O-ring (10) is in the correct position during installation. The O-ring is delivered loose with the gearbox and has to be coated with grease before being inserted into the seal groove in the housing (6).

Check the position of the gearbox shift mechanism. The sliding sleeve must be in the 1st gear position ("low" gear ratio).

Low gear	High gear
	

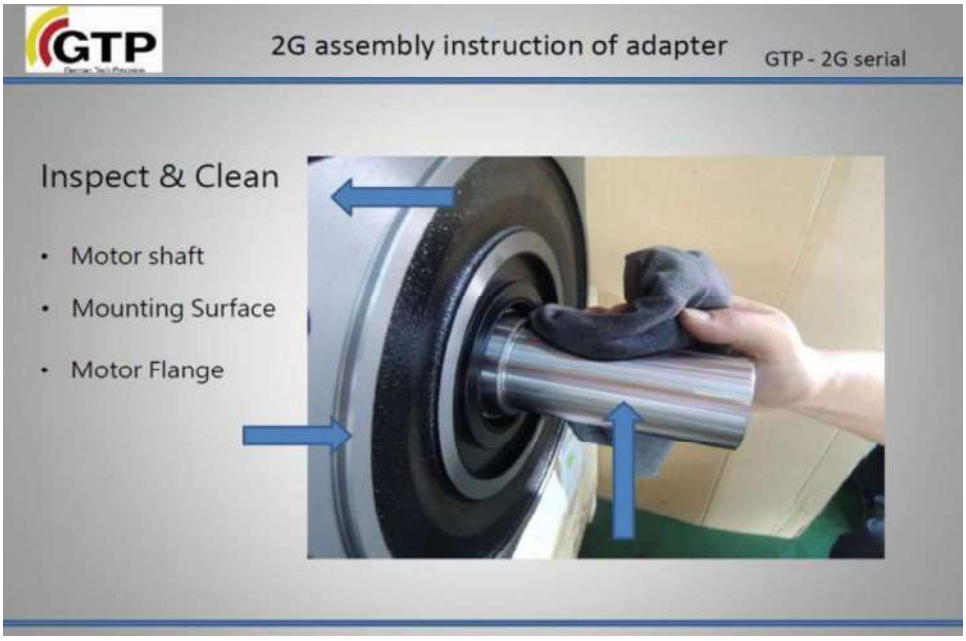
Take up the gearbox and place it onto the motor flange. Carefully bring the sun gear/hub connection together when doing this.

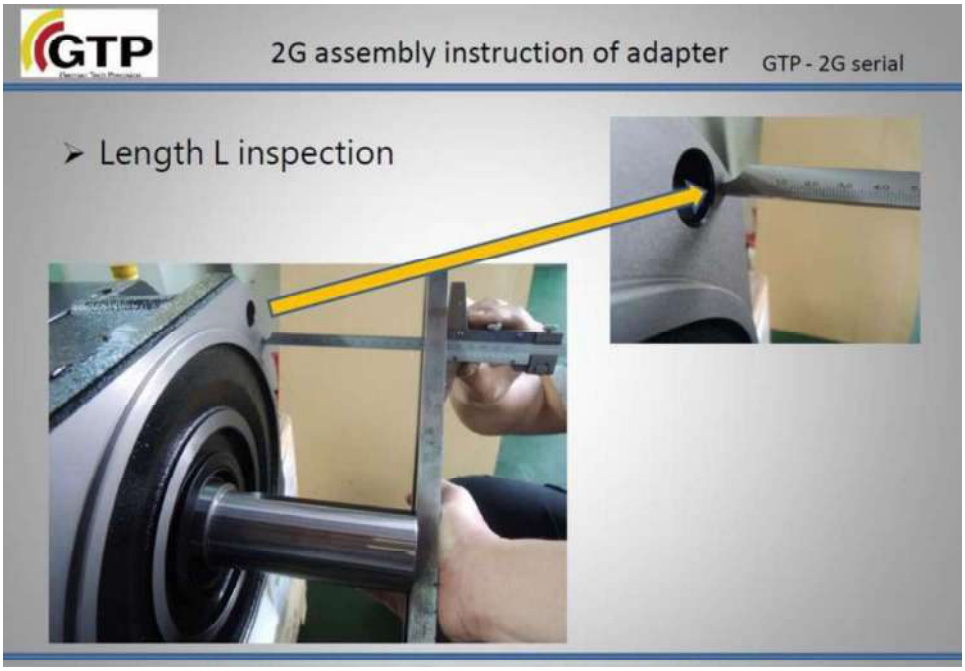
The external spline of the sun gear must be guided into the internal spline of the hub.
This can be made easier by turning to the left or right at the gearbox output.
The gearbox housing, adapter plate and motor are bolted together using four/eight hexagon bolts (11).

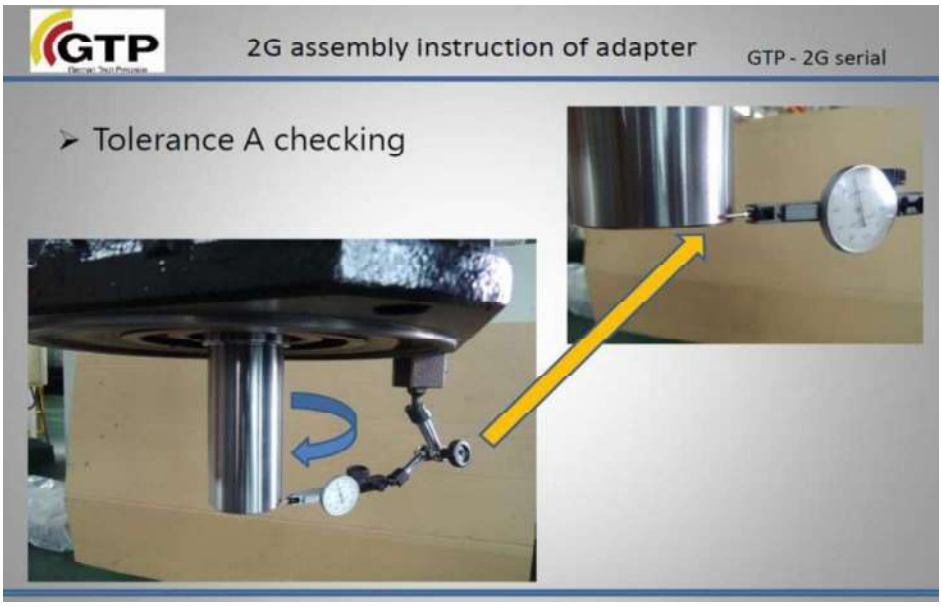
Fill the gearbox with oil and connect up the re-circulating lubrication system and the power supply. The breather outlet must always be at the top, regardless of the installation position. The breather is screwed in to the B5 position ex-works. The gearbox is now ready for use.

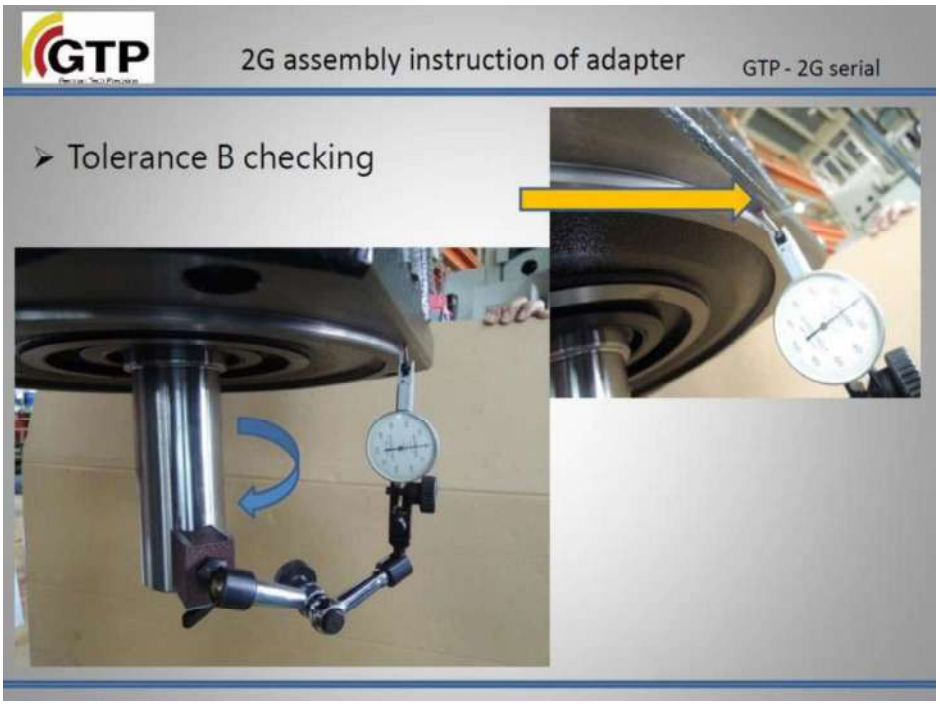
The gearboxes can be operated under the same degrees of protection as those defined for AC and DC motors. When setting up, make sure that the motor cooling air can flow in and out unhindered.

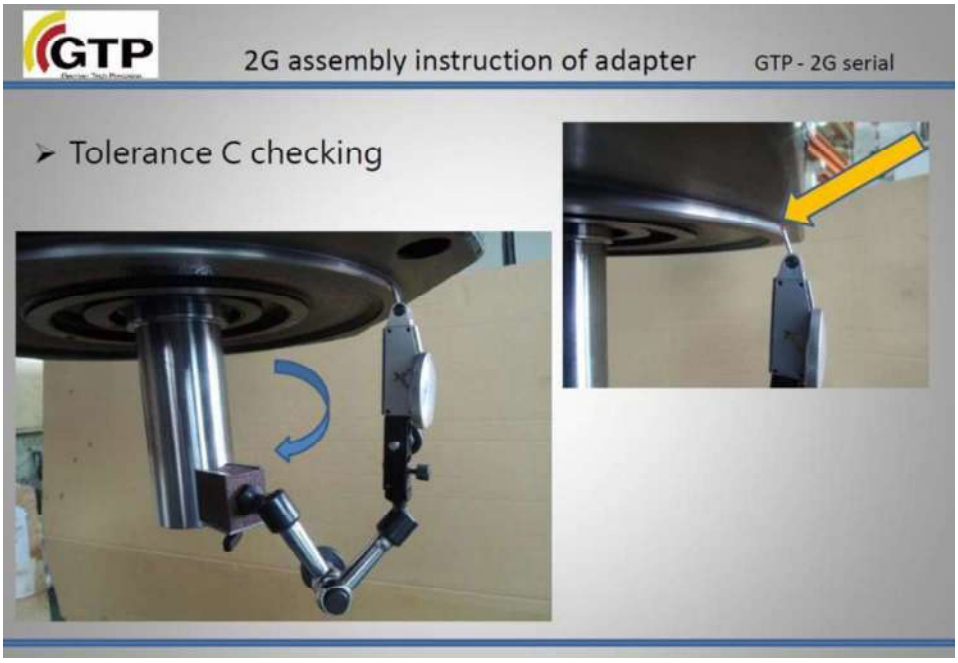
4.4.3 2G adapter plate installation

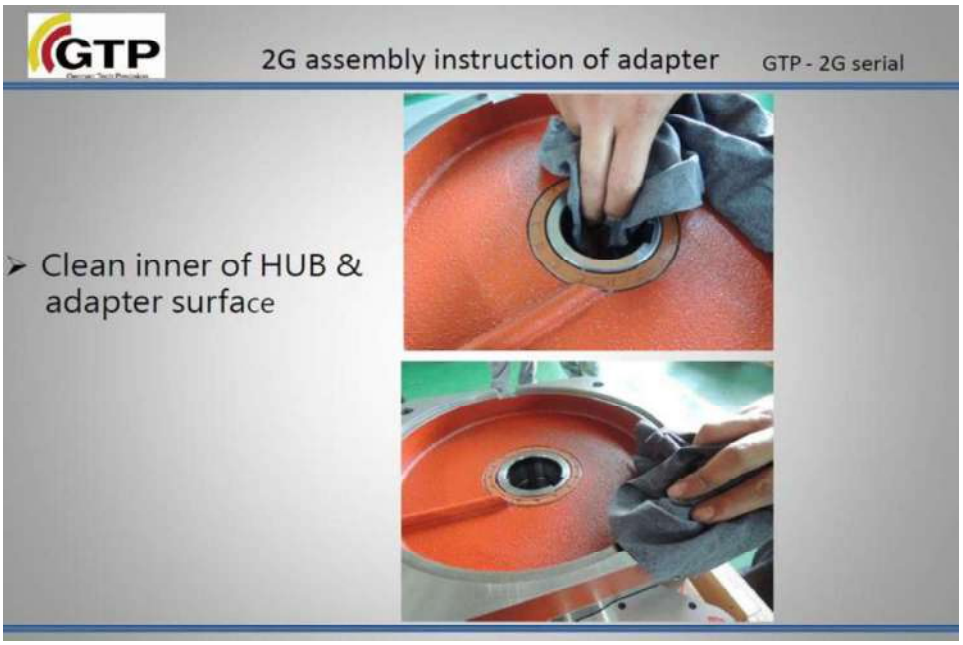


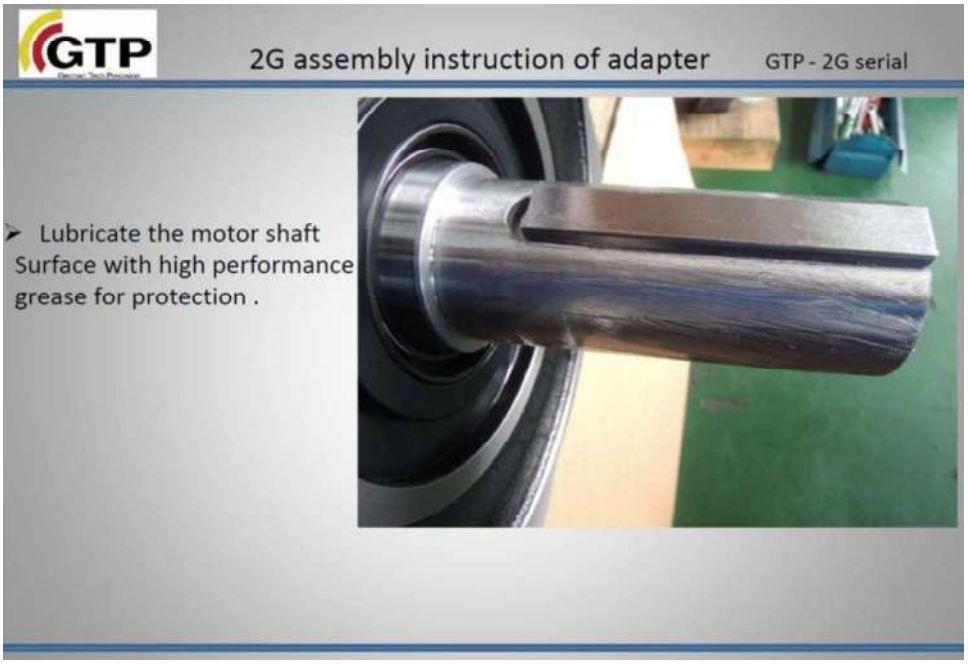


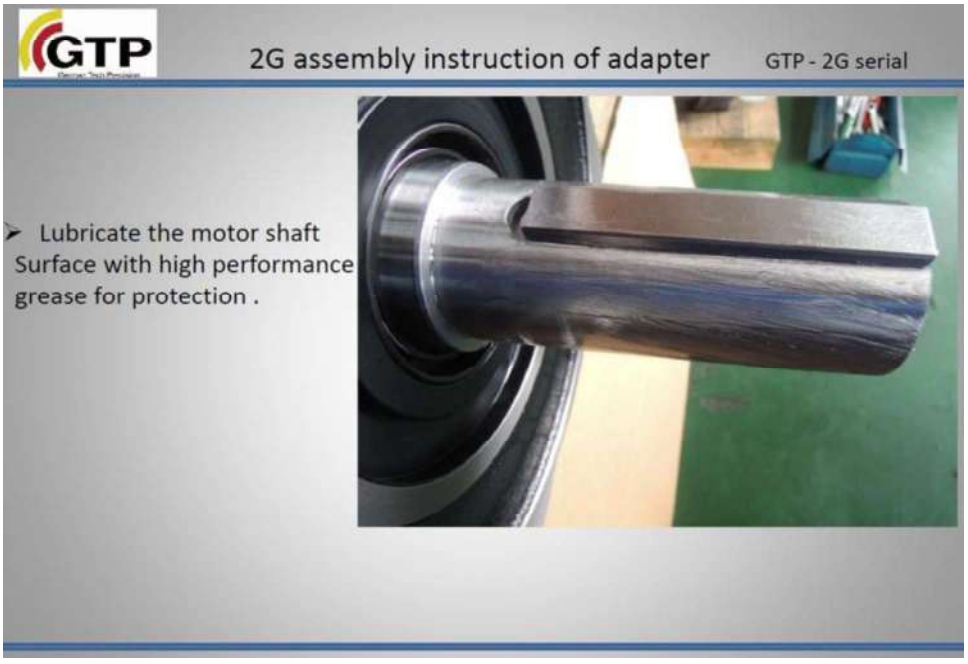

GTP
2G assembly instruction of adapter
GTP - 2G serial
➢ Tolerance A checking

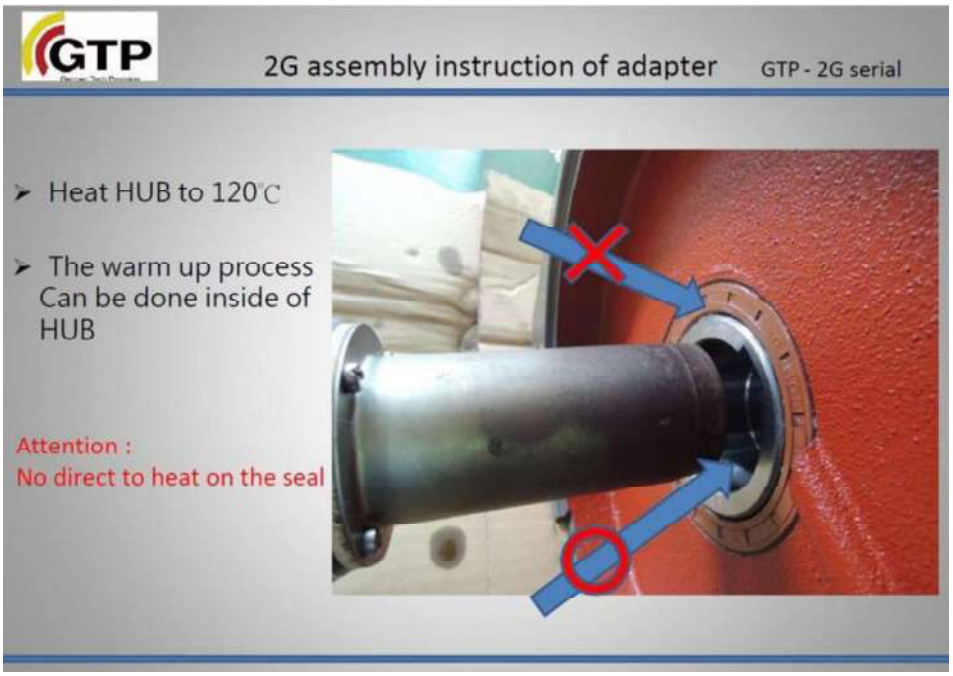

GTP
2G assembly instruction of adapter
GTP - 2G serial
➢ Tolerance B checking

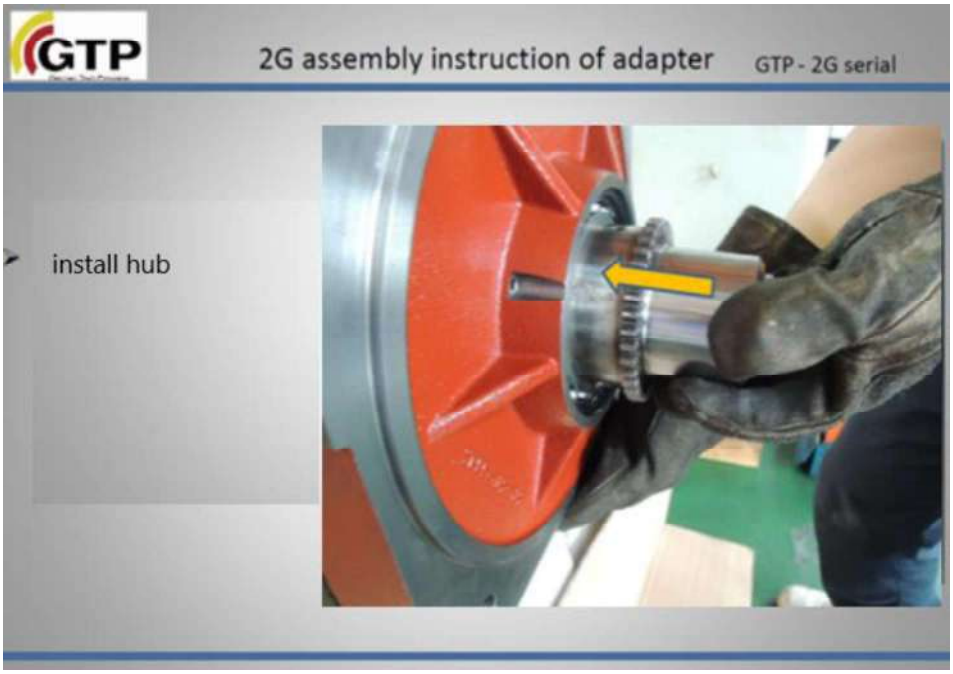

2G assembly instruction of adapter
GTP - 2G serial
Tolerance C checking


2G assembly instruction of adapter
GTP - 2G serial
Clean inner of HUB &
adapter surface


2G assembly instruction of adapter
GTP - 2G serial
Lubricate the motor shaft Surface with high performance grease for protection .


2G assembly instruction of adapter
GTP - 2G serial
Lubricate the motor shaft Surface with high performance grease for protection .


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


2G assembly instruction of adapter
GTP - 2G serial
install hub

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 .

2G assembly instruction of adapter

GTP - 2G serial

To obtain correct HUB position , measurement D
Measure the HUB surface to adapter surface .
Measurement is 2G120 72.8-73
2G121 92.8-93

Gearbox	Dimension D mm
2G120	73-0.2
2G121	93-0.2

4.5 Output

GTP two-speed gearbox 2G120/121 have two types of output.

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.

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.

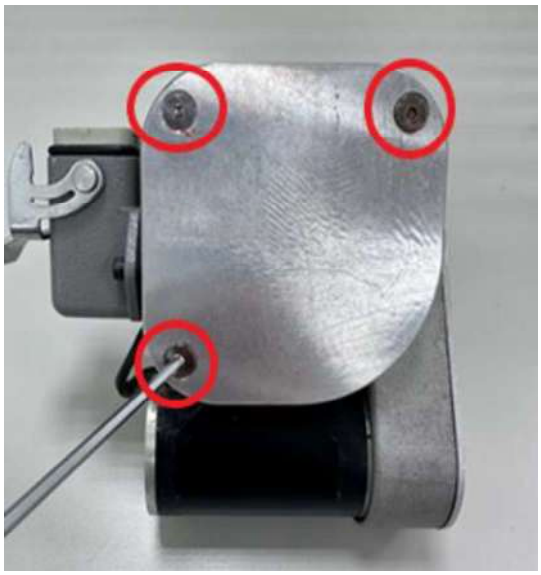
4.7 Installation

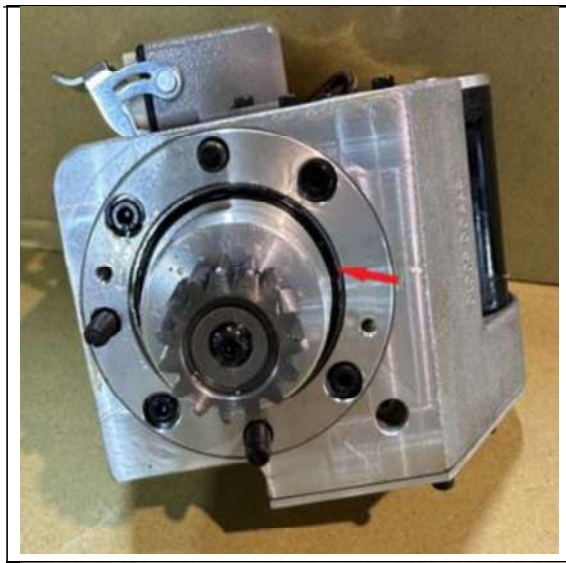
Installation position of GTP two-speed gearbox 2G120/2G121 is B5/V1/V3
Shift unit can be located on the right side or top of the gearbox.
The breather outlet must always be at the top, regardless of the installation position.

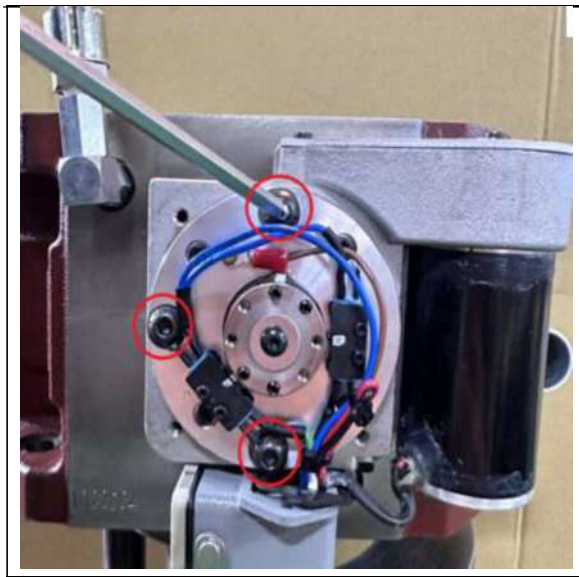
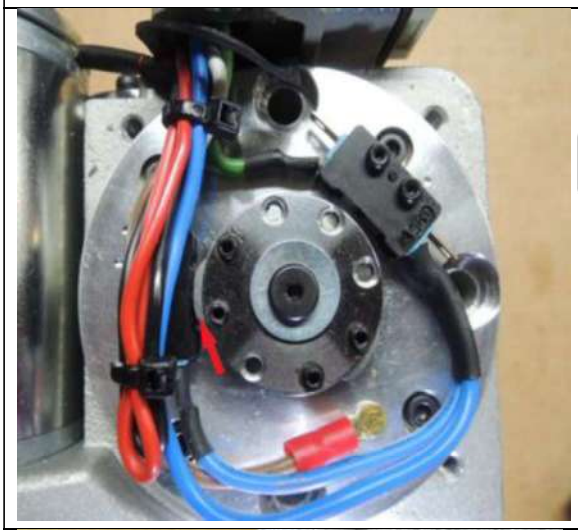
When install the motor onto the gearbox, support B side of the motor to

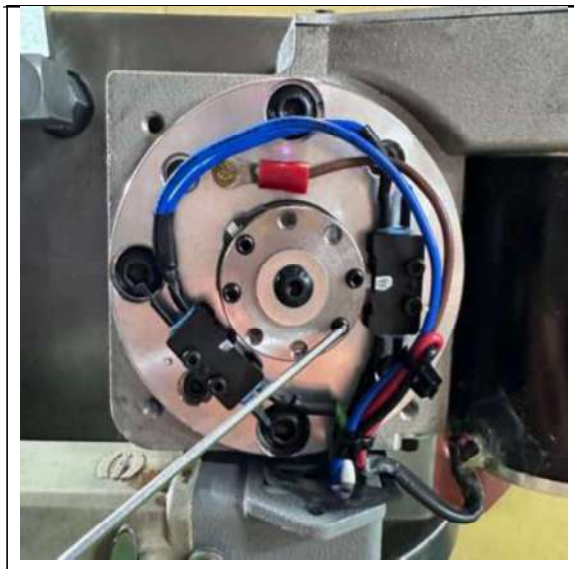
reduce the vibration. When assembly make sure no blockage on the fan.
Oil is out of supply scope. Before starting the gearbox, please assure enough oil quantity and oil pressure.
Input flange, output flange and output shaft rotate at a very high speed, must provide proper protection cover, otherwise there will be danger of injury!

4.7.1 Shift unit installation

	Confirm gear box in low gear before dismantle shift unit. 1.Open shift unit cover.
	2.Dismantle bolt (M3X10)

	3.Install O-ring Apply Vaseline or grease , make sure the O-ring adhere inside.
	4. Using Locatite 243 lock bolt
	5. Install shift unit into gear box Make sure O-ring in correct position.

	6. Screw torque 23Nm
	7. Confirm the central cam turning in correct position. one dot : low gear two dot : high gear
	8. Switch to low gear first, and confirm central cam in correct position. (low gear mark: one dot) If central cam in wrong position, loose bolts and adjust it.

	9. Switch to high gear, and confirm central cam in correct position.
	10. Install cover back
	11. Lock bolt

4.8 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

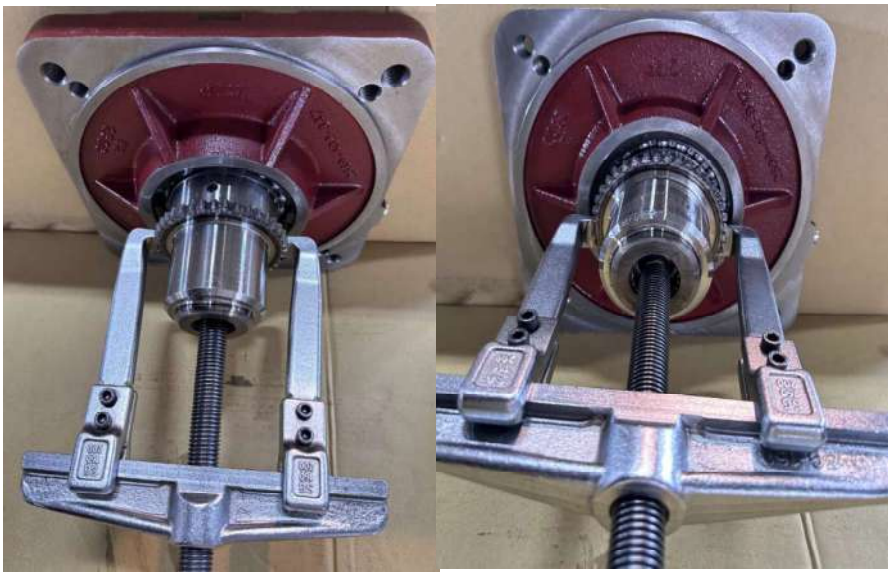
Fault	Cause of fault	Tips
Gearbox is loud, running noise	a) engaging/friction noise: bearing damage b) Knocking noise: drive c) Rotating noise: wrong installation of output shaft.	a) contact GTP service. b) contact GTP service. c) Mount the output shaft onto the spindle correctly, careful about second 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 b) sealing	a) rubber seal of the gear cover has a leakage b) sealing defect c) oil cannot return to oil cooler	a) Tighten the screw between gear cover and gear, if still leakage please contact GTP service. b) Contact GTP service. c) Check the oil quantity and remove the foreign object, if still leakage please contact GTP service.
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
- Pull the gearbox off the adapter plate and hub

Hub:

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



1.Make sure hub seal disc in the center before dismantle, otherwise hub seal disc may stuck.

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