



## BHS Rotor Turning Units

### Applications

BHS Rotor Turning Units are well suited for the following applications:

- **Break-away and start up systems for shaft trains**

Very often the starting torque of the prime mover is insufficient to initiate rotation of the shaft trains. The use of a rotor turning device eliminates the need for hydrostatic bearings. The peak current required for normal start up can be greatly reduced.

- **Low speed turning of Rotors**

Continuous rotation of the rotors at low speeds avoids rotor deformation during the cooling down phase.

- **Prevents fouling and deposits of particulate matter in the blade channels**

Unless continuously rotated after shutdown, the rotors of expansion turbines and compressors working with impure gases may become unevenly coated with deposits. These deposits may increase the unbalance levels and/or the rotor may become bound to the stator.

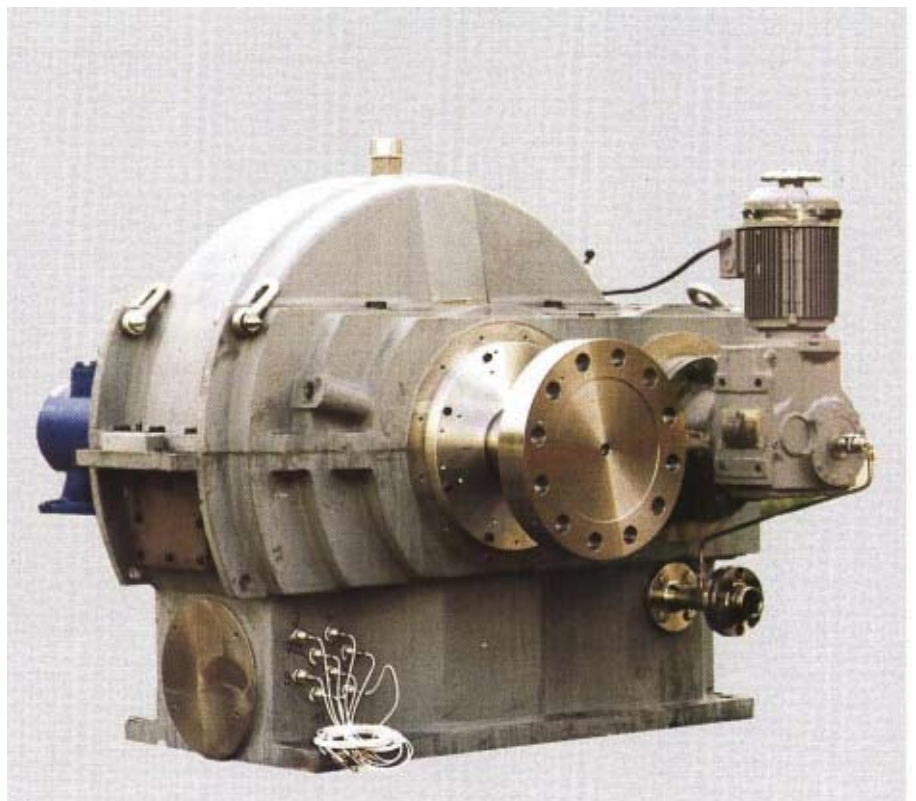
- **Alignment and positioning units for large shaft trains**

Turning units allow shaft trains to be slowly rotated in order to record radial and axial values for runout and to facilitate the connection of shafts and couplings.



*Figure 1:  
BHS  
Rotor Turning  
Unit,  
Type RDV 1.*

*Figure 2:  
BHS  
H-Series Gear  
with an  
attached Rotor  
Turning Unit,  
Type RDV 60.*



## Arrangements and Functionalities

### In Shaft Train Configuration

#### Operation

For shaft trains without a free shaft end, the Rotor Turning Unit has to be integrated into the shaft train. This is done by mounting the turning unit on a bearing housing or coupling guard, which is also recommended for BHS Epicyclic Gears.

Rotor Turning Units, type RDV 1 through RDV 5, operate based upon the swiveling pinion principle. During start up, the swiveling pinion drives a gear rim in the shaft train. Once the shaft train is under its own power, the swiveling pinion is pushed out of the mesh with the external gear rim. The pinion is secured in the disengaged position.

#### Features

- Installation on a horizontal mounting flange, above the gear rim.
- Easy installation and removal without complicated alignment.
- Various turning unit Options are available, ref. page 4.
- Units feature bevel gears, which use smaller drive motors than worm gear designs.
- Simple and robust construction, using standardized components.
- Thermal growth of the shaft train is unlimited.
- Equipped with handwheel and hexagon drive.
- Various explosion-proof systems of electric protection available.
- In-house testing available.

### BHS Rotor Turning Units Typ RDV 1 - 5

#### Swiveling Pinion

**Break-away torque:  
300 - 100000 Nm**

**Turning speed:  
20 - 400 rpm**

**Units driven  
by electric or  
hydraulic motor**

### Shaft End Mounting Configuration

#### Operation

For shaft trains with a free shaft end, completely automatic BHS Rotor Turning Units, type RDV 60 through RDV 150, are available.

On BHS Parallel Shaft Gear Units, the Rotor Turning Drive can be mounted on the free end of the pinion shaft. The turning unit drives the shaft train through an over running clutch, which disengages automatically once the drive train is operating. Turning drives on reversing shaft trains must be equipped with a sprag clutch or motor retaining brake to prevent engagement of the clutch when operating in reverse.

#### Features

- Fully automatic, self-shifting clutch eliminates need for checking the shifting condition
- Units feature bevel gears, which use smaller drive motors than worm gear designs.
- Turning units made from standard components. Spare parts are available on short notice.
- Low weight output range minimizes impact on shaft line rotor dynamics, thus making it suitable for maximum speeds.
- Equipped with handwheel and hexagon drive.
- Various explosion-proof systems of electric protection available.

### BHS Rotor Turning Units RDV 60 -150

#### Overrunning Clutch

**Break-away torque:  
300 - 25 000 Nm**

**Turning speed:  
3 - 300 rpm**

**Units driven  
by electric or  
hydraulic motor**

## Optional Features

### Swiveling Pin on Turning Units

#### Standard

The turning device is manually engaged with the shaft train at standstill. A limit switch releases the drive motor, allowing the shaft train to turn. During acceleration of the shaft train, the swiveling pinion disengages automatically and is secured in a disengaged position.

A limit switch for safety locking of the hand-wheel cover is provided.

#### Automatic I

In addition to the functions offered by the standard version, the „Automatic I“ system allows a remote controlled engagement by means of an installed hoisting magnet or pneumatic cylinder while the shaft train is at a standstill.

#### Automatic II

In addition to the functions offered by the „Automatic I“ system, „Automatic II“ allows the turning unit to synchronize with the shaft train while the shaft train is decelerating. The supplied control module assures automatic operation. Speed sensors on the shaft train release a command for the start and stop of the turning unit motor within a specific speed range. Speed sensors on the swiveling pinion allow smooth and controlled synchronization.

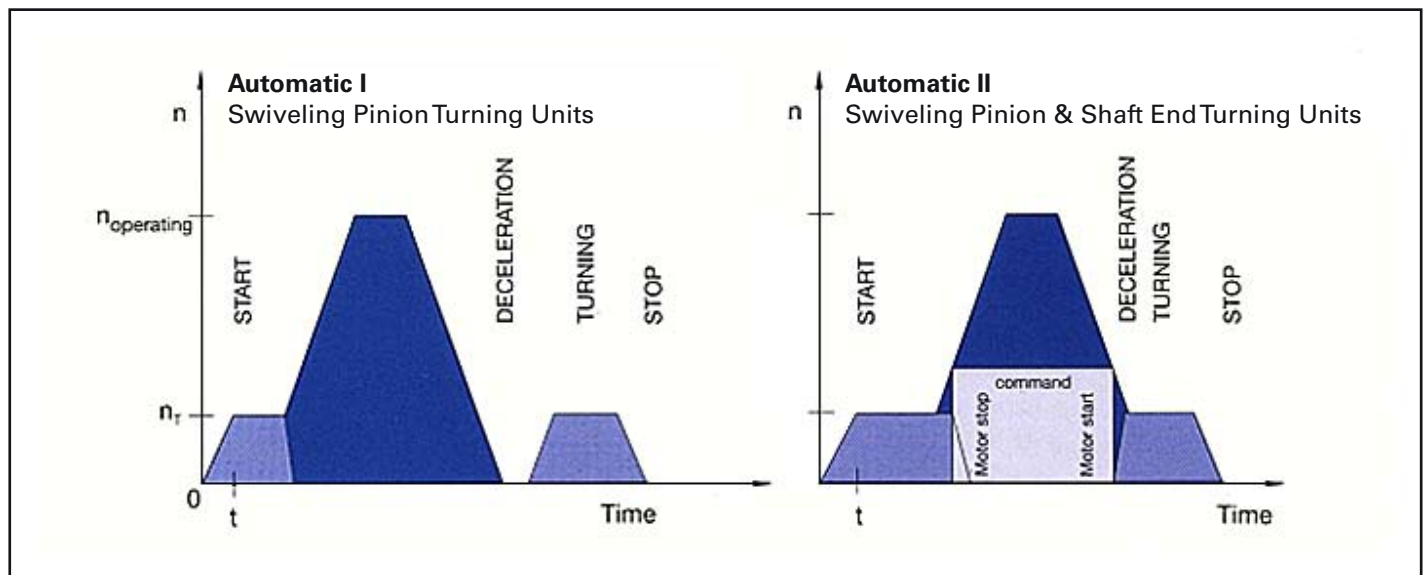


Figure 3: Features of BHS

Rotor Turning Units

### Shaft End Turning Units

#### Standard

The standard BHS Turning Unit is equipped with a self-synchronizing overrunning clutch. A limit switch for safety locking of the hand-wheel cover is provided.

#### Options

Available accessories:

- Motor retaining brake
- Motor control center
- Sprag clutch
- Position sensor for coupling engagement status.

## Rating

Selection of the appropriate rotor turning unit is based upon the shaft train break-away torque. The type and power of the turning unit required are determined by means of diagrams 1 and 2.

For swiveling pinion turning units, the size of the shaft train gear rim depends upon the space constraints of the application. The connection between the external gear rim diameter and the H dimensions can be determined from diagram 3.

BHS-C RDV Typ	$d_{os}$ (mm)	Module (rom)
RDV 1	100	4
RDV 2	120	5
RDV 3	156	6
RDV 4	180	6
RDV 5	Upon request	

*The external gear rim is made per customer requirements.*

Tabelle 1

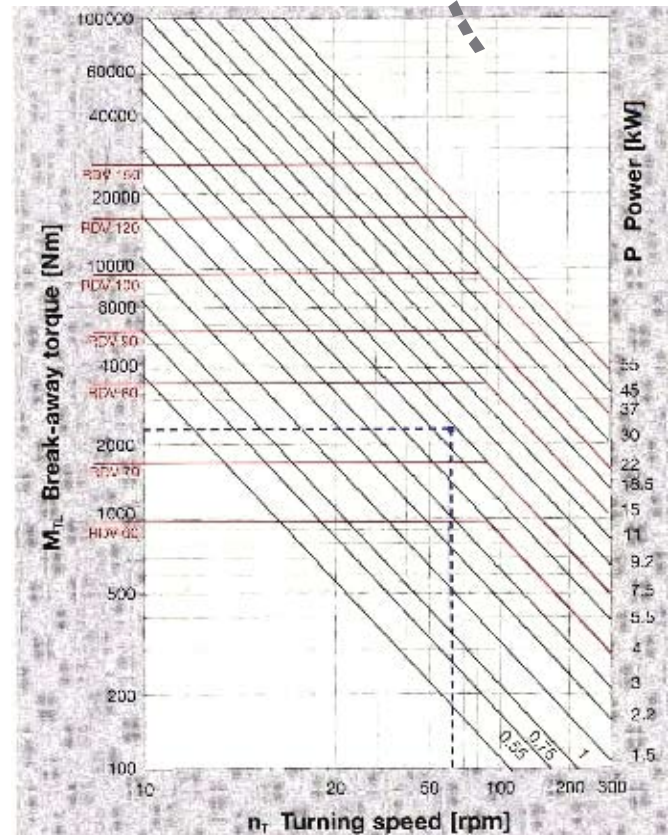


Diagram 1: Selection diagram, Shaft End Turning Unit, Type 60 -150.

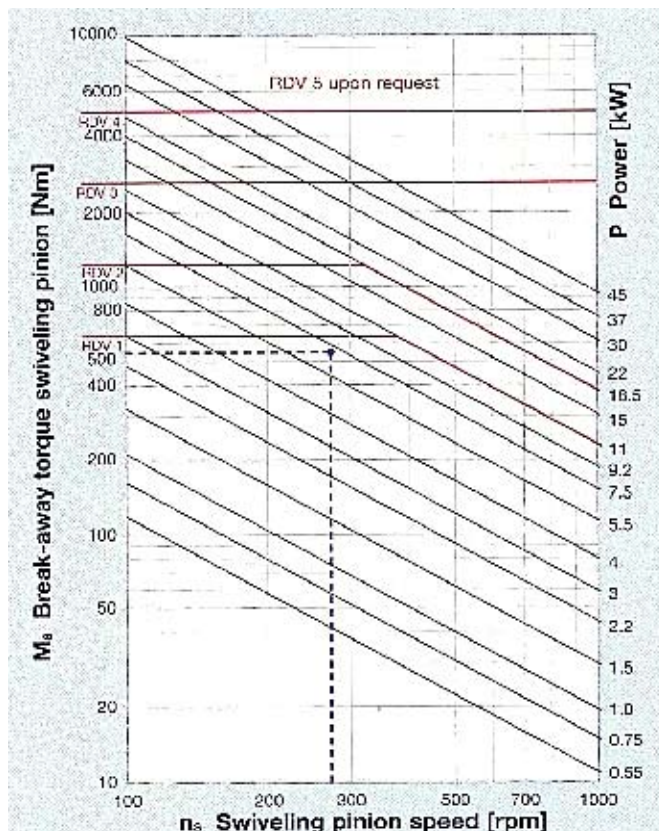


Diagram 2: Rating diagram, Swiveling Pinion Turning Unit, Type 1-5.

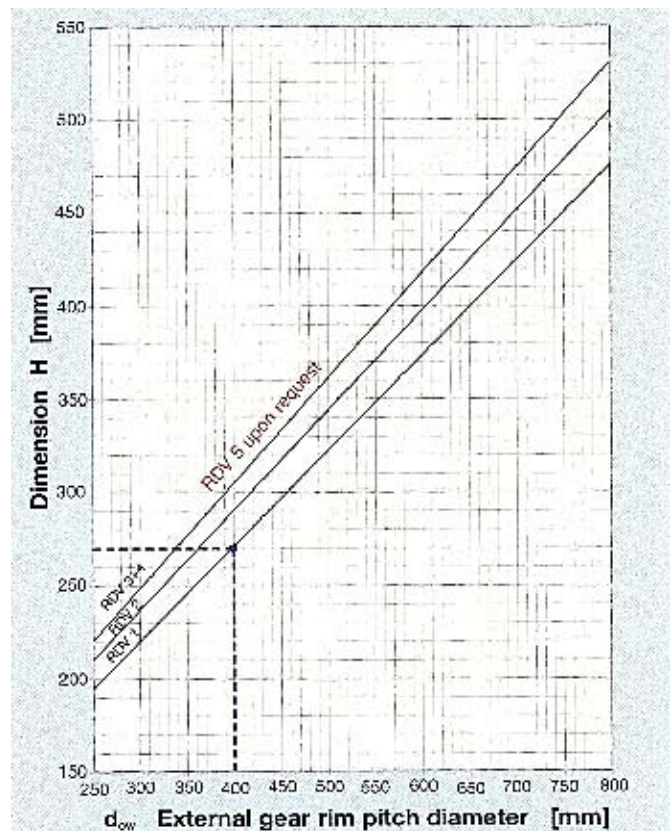


Diagram 3: Selection diagram, Dimensions H depend upon the pitch circle diameter of external ring gear.

### Formula Designations:

$d_{OS}$ [mm]	Swiveling pinion pitch diameter (RDV 1 - 5, table 1)
$d_{OW}$ [mm]	External gear rim pitch diameter (RDV 1 - 5, diagram 3)
$J$ [kgm <sup>2</sup> ]	Mass moment of inertia of the shaft train (m <sup>2</sup> )
$M_S$ [Nm]	Break-away torque at the swiveling pinion (RDV 1 - 5, diagram 2)
$M_{TL}$ [Nm]	Break-away torque required at the shaft Attention: For shaft trains with hydrostatic bearings use double the values of $M_{TL}$ obtained from diagram 1 or diagram 2
$N$ [1]	Acceleration factor
$n_S$ [rpm]	Swiveling pinion shaft speed (RDV 1 - 5, diagram 2)
$n_T$ [rpm]	Turning speed of the shaft train
$P$ [kW]	Electrical power
$t$ [sec]	Acceleration time

Once the suitable turning unit has been selected, the application must be analyzed to determine whether the shaft train can be accelerated to the turning speed without overheating the motor:

$$t=0,12 \cdot (J/M_{TL}) \cdot (n_T/N+30/N^4)$$

$$N = \frac{M_{TL} \text{ resp. } M_S \text{ (existing for P)}}{M_{TL} \text{ resp. } M_S \text{ (required)}}$$

approximate value:  $t \leq 12$  sec.

## Dimensions

### Swiveling Pinion Tuning Unit Type RDV 1 - 5

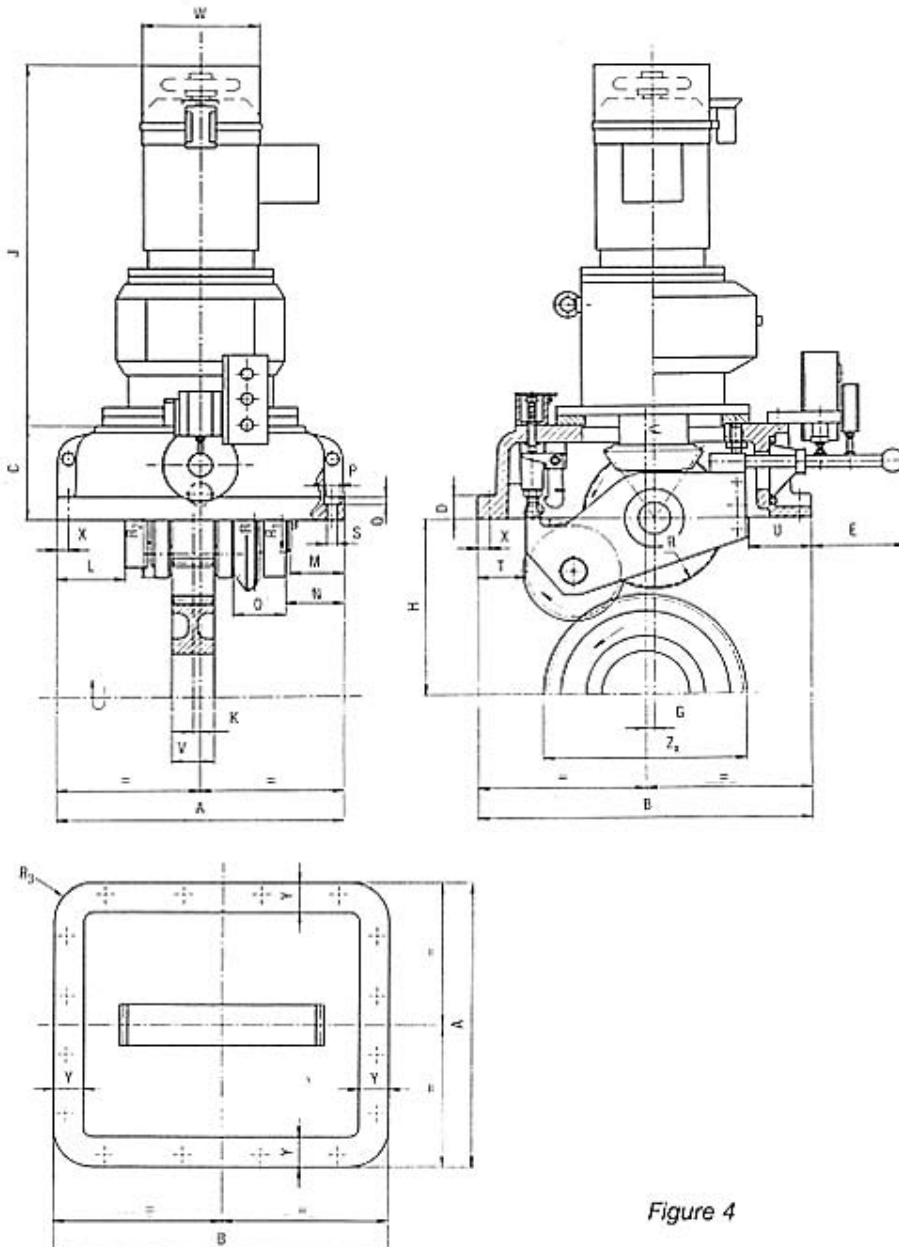


Figure 4

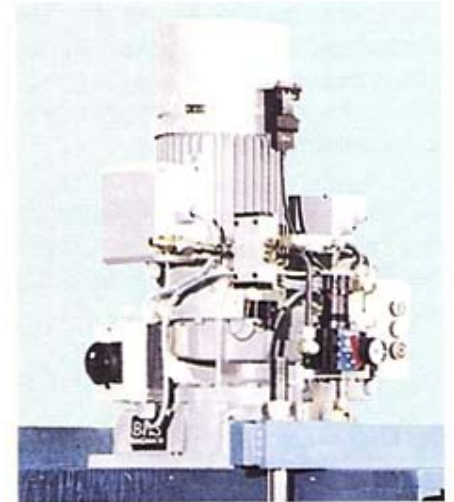


Figure 5: BHS Rotor Turning Unit on the test stand especially set up for this application.

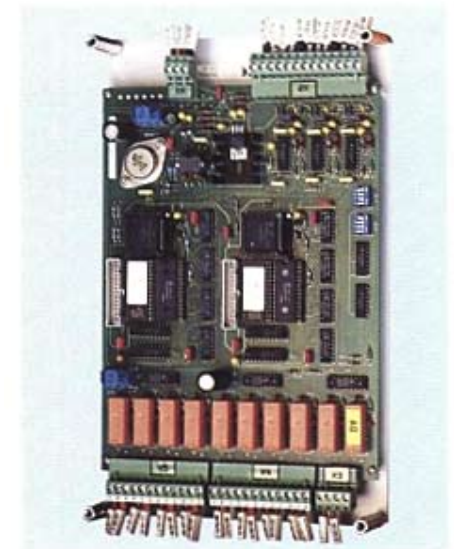


Figure 6: BHS Rotor Turning Unit Control Module. The photograph shows the turning speed circuit board.

Size	A	B	C	D	E	G	H	J	K	L	M	N	O	P	Q	R	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	S	T	U	V	W	X	Y	Z	
RDV 1	285	415	105	22	165	40		depend. upon motor size	0	55	38	45	58	20	10	92	38	60	20	14	79	55	35	depend. upon motor size	16	40	depend. upon motor size	
RDV 2	400	480	150	32	135	0	see diagram 3		0	75	63	74	75	20	10	110	50	105	50	14	65	80	50	depend. upon motor size	20	45	depend. upon motor size	
RDV 3	480	560	160	40	160	0			12	105	78	86	88	26	13	120	54	103	65	18	80	120	70	depend. upon motor size	20	50	depend. upon motor size	
RDV 4	600	730	195	45	140	0			0	74	81	85	147	33	17	143	54	115	65	23	95	185	70	depend. upon motor size	25	65	depend. upon motor size	
RDV 5	Upon request																											

Table 2

## Examples:

### Swiveling Pinion Turning Unit

Required  $d_{ow}$  = 400 mm

Required  $M_{TL}$  = 2200 Nm  
(calculated with a friction factor of 0,2)

Desired  $n_T$  = 65 rpm

Mass moment of inertia = 1600 kgm<sup>2</sup>

$$M_S = M_{TL} \cdot d_{os}/d_{ow}$$

Assumption RDV 1,  $d_{os}$  = 100 mm

$$M_S = 2200 \cdot 100/400 = 550 \text{ Nm}$$

$$n_S = n_T \cdot d_{ow}/d_{os}$$

$$n_S = 65 \cdot 400/100 = 260 \text{ rpm}$$

-> ref. diagram 2: RDV 1 with P = 7,5 kW

-> ref. diagram 3: Dimension H = 270 mm

### Shaft End Turning Unit

Required  $M_{TL}$  = 2200 Nm  
(calculated with a friction factor of 0,2)

Desired  $n_T$  = 65 rpm

Mass moment of inertia = 1600 kgm<sup>2</sup>

-> **ref. diagram 1: RDV 80 with P = 7,5 kW**

Acceleration time:

$$t = 0,12 \cdot (1600/2200) \cdot (65/1,091 + 30/N^4)$$

$$N = 600/550 = 1,091$$

$$t = 0,087 \cdot (59,578 + 21,175) = 7 \text{ sec.}$$

-> Turning drive sufficiently dimensioned.

## Dimensions

### Shaft End Mounted Turning Unit Type RDV 60 - 150

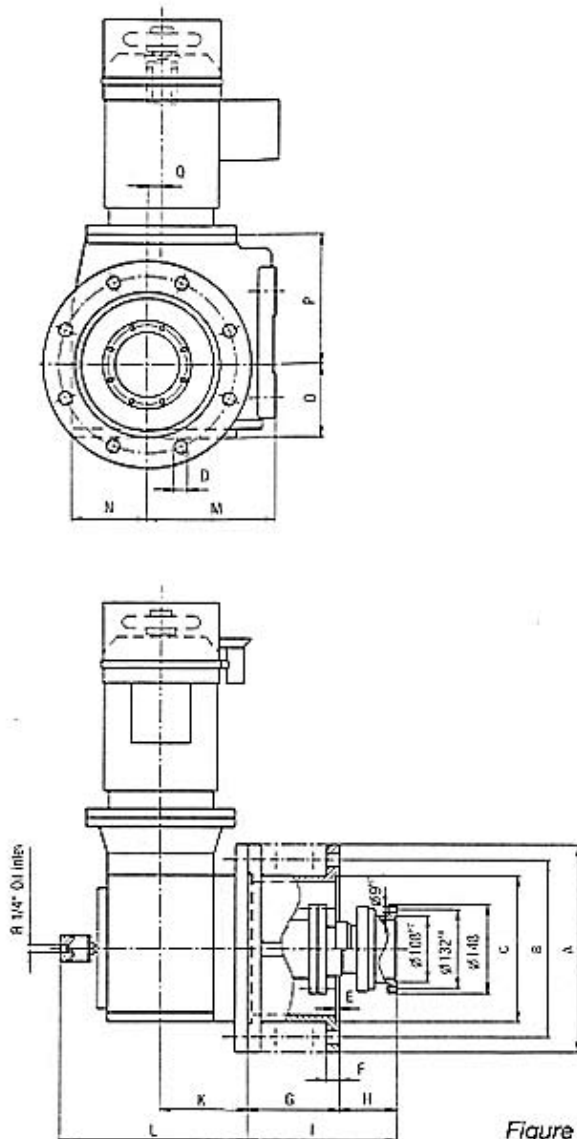


Figure 7



Figure 8: BHS RDV 90  
without adapter casing.

**Let BHS review your  
turning drive and  
recommend a solution.**

To enable us to provide a complete quotation, please furnish the following information:

- Break-away torque
- Turning speed
- Mass moment of inertia
- Electrical requirements
- Installation arrangement.

Größe	Ø A	Ø B	Ø C	Ø D	E	F	G	H	I	K	L	M	N	O	P	Q
RDV 60	250	215	180	8x14	5	15	197	-4	193	113	263	140	86	87	179	20
RDV 70	250	215	180	8x14	5	15	197	16	213	142	307	180	106	107	202	31.3
RDV 80	350	300	250	8x18	7	20	153	90	243	150	327.5	212	126	125	257	25.9
RDV 90	450	400	350	8x18	7	22	173	90	263	192	402	265	149	154	277	32.3
RDV 100	450	400	350	8x18	7	22	228	65	293	216	450.5	315	185	185	341	52
RDV 120	550	500	450	8x18	7	25	268	65	333	256	490.5	375	217	225	390	53
RDV 150	660	600	550	8x22	7	28	268	65	333	310	544.5	450	255	280	426	71.7

Table 2



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