



Introduction

The compact Hyosung gearbox transmits power from the electric motor to the grinding table. It reduces the speed of the electric motor to the desired speed of the grinding table and changes the horizontal input axis to a vertical output. The gear unit also supports grinder, mounted on the output disc. An external oil supply unit lubricates and cools the gear unit.

The BPPV model consists of one bevel gear and one planetary gear stage with Hyosung technology. The KPAV model has also features one bevel and one planetary gear stage but is based on RENK technology.

The BPPCV model has one bevel and two planetary two planetary gear stages with Hyosung technology and is currently in development.



Gearing

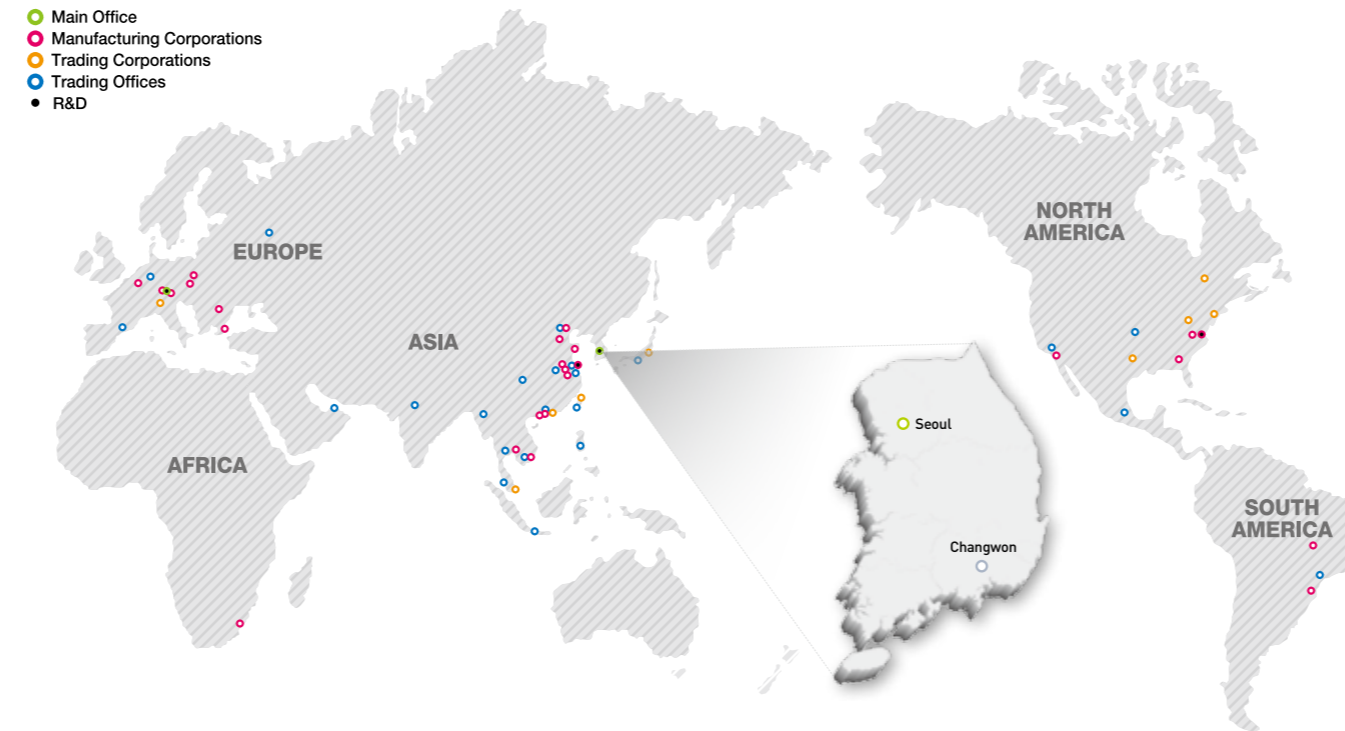
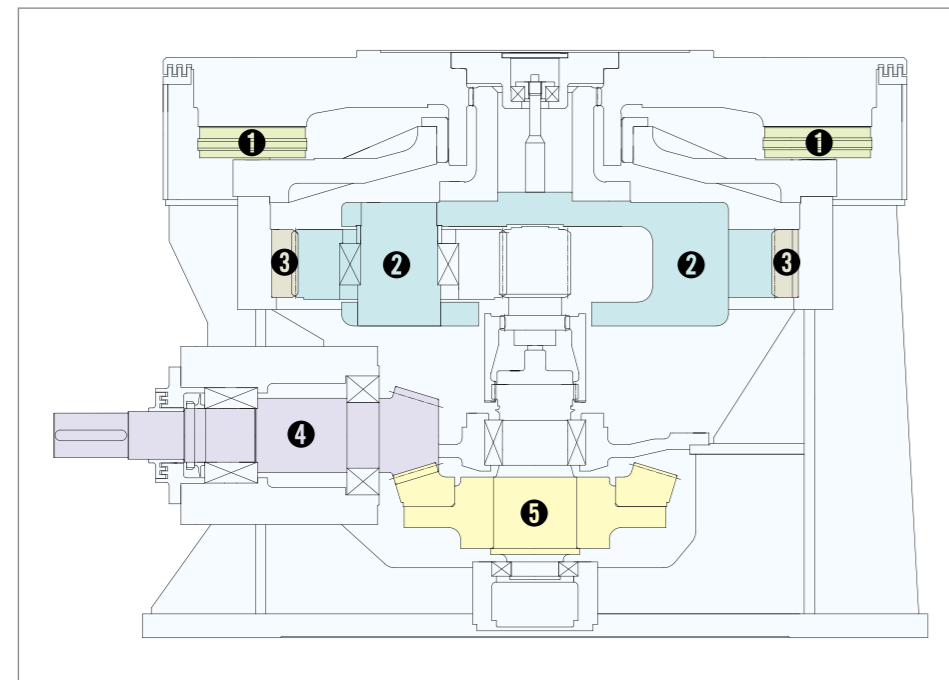
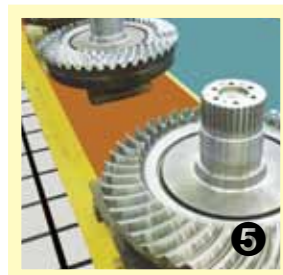
The bevel and planetary stage gears are made from high quality material, precise cut on top class machines and heat treated in house. The gear teeth have both profile and crowning to fully compensate for deflections of the sun pinion and planet wheels occurring while under maximum load. This method guarantees optimal tooth contact and a prolonged life cycle.



Thrust bearing

The thrust bearing absorbs the static and dynamic grinding forces experienced while in use. There are two kinds, the hydronamic type lubricated by low-pressure pumps or the on-demand hydrostatic type.

The axial thrust bearing's design is based on the required lubrication film, the geometry of the circular pads, load, circumferential speed and oil viscosity.



VERTICAL ROLLER MILL GEAR BOX



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General

Global Gear Solution Provider

Since 1962, Hyosung has been manufacturing gear products of the highest quality and integrity. With superior design technology and highly advanced automated manufacturing facilities, Hyosung products are built to last. Since entering into a technical partnership with RENK in 1977, Hyosung has leveraged RENK's design skill and technical know-how, to develop a line of products stretching from helical gearboxes to planetary gearboxes.

Now, Hyosung is operating under a licensing agreement with RENK to produce various types of vertical roller mill gearboxes including the KPAV 140, 160 and 180.

Application

Vertical roller mills are used to pulverize coal, cement components (Limestone, Clinker, Gypsum) and slag into fine particles. Since 1993, Hyosung has supplied approximately 300 gearboxes for vertical roller mills in various countries. These vertical roller mills have been operating free from defects for over 20 years. To meet customer's demands for increased capacities in their facilities, Hyosung has also improved the allowable torque for the vertical roller mill gearboxes.



Advantages

Compact & Competitive



The package-type, space saving design results in reduced weight by dividing power across several planetary gears.

More Efficiency



Higher efficiency as a portion of the power in the planetary stage is transmitted without losses. The axial bearing pads are arranged directly above the housing wall, so that a partial deformation of the axial bearing due to axial forces coming from the mill are avoided. The grinding forces from the mill are transmitted directly into the foundation over a circular symmetric housing with nearly uniform stiffness.

Convenient maintenance



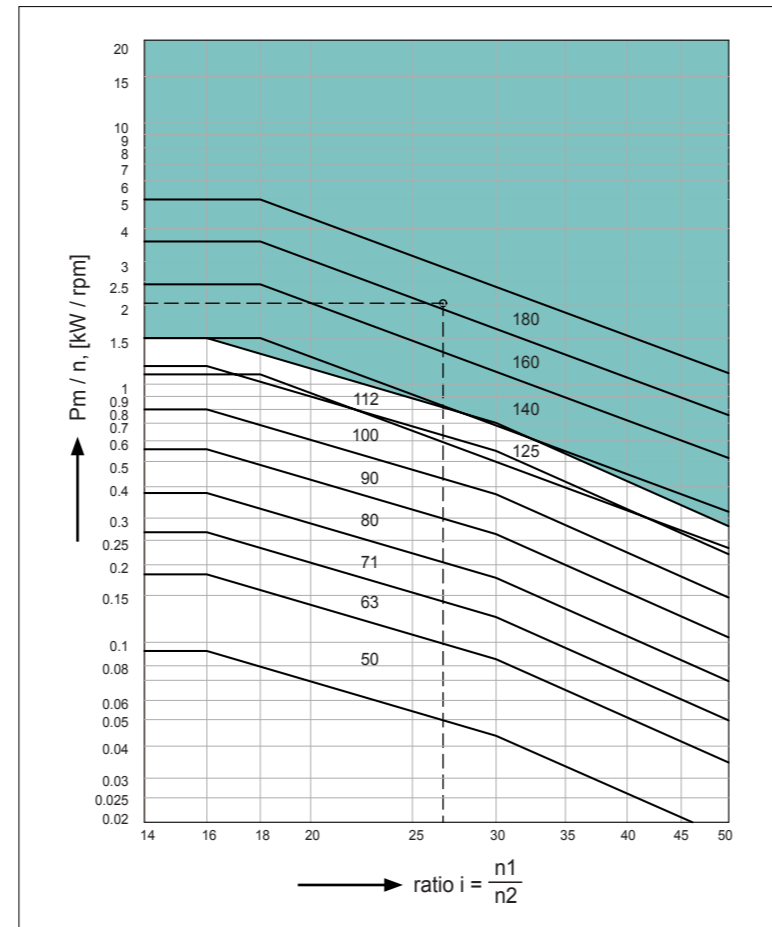
The roller mills are particularly easy to assemble and disassemble because pressure plates and gears can easily be dismantled, but also because there is no need to seal the joint surfaces as is required for split housings.

Low noise



As only part of the power in the planetary stage is transmitted by the gear teeth, the overall noise level is lowered. More-over, the high-speed bevel gear stage is located centrally within the gear unit, contributing to additional noise damping.

Selection of gearbox size



Application

Grinding of Coal		Grinding of Limestone	
Gear unit size for the white area of the chart. BPBV50-125		Gear unit size for the shaded area of the chart. KPAV140~180	
AGMA 2.0 corresponds to the Hyosung target service factor 1.6		AGMA 2.5 corresponds to the Hyosung target service factor 1.8	
AGMA 2.5 corresponds to the power factor		AGMA 2.5 corresponds to the power factor	

TYPE	Tab_max [kgm]	TYPE	Tab_max [kgm]
BPBV	50	BPPCV	110
	63		130
	71		150
	80		170
	90		180
	100		204,082
	112		204,082
KPAV	140		
	160		
	180		

Power Rating

The gear unit size is determined in accordance with diagram on the left.

The following values are needed;

$$\text{Power factor} = \frac{PM}{n1}$$

$$\text{Speed factor} = \frac{n1}{n2}$$

AGMA service factor, if required.

PM = Input power (kW)

n1 = Input speed (rpm)

n2 = Output speed (rpm)

i = Speed factor

Example

PM = 2000 kw

n1 = 990 rpm

n2 = 37 rpm

AGMA service factor 2.0

$$\frac{PM}{n1} = \frac{2000}{990} = 2.02$$

$$\frac{n1}{n2} = \frac{990}{37} = 26.76$$

The diagram uses the AGMA service factor 2.0. The result is the **KPAV 180** gear box.

Torque

The gear unit size is determined in accordance With Table 1. The following values are needed;

$$\text{Torque (T)} = \frac{974 \times PM \times \text{Speed factor}}{\text{Input speed}(n1)}$$

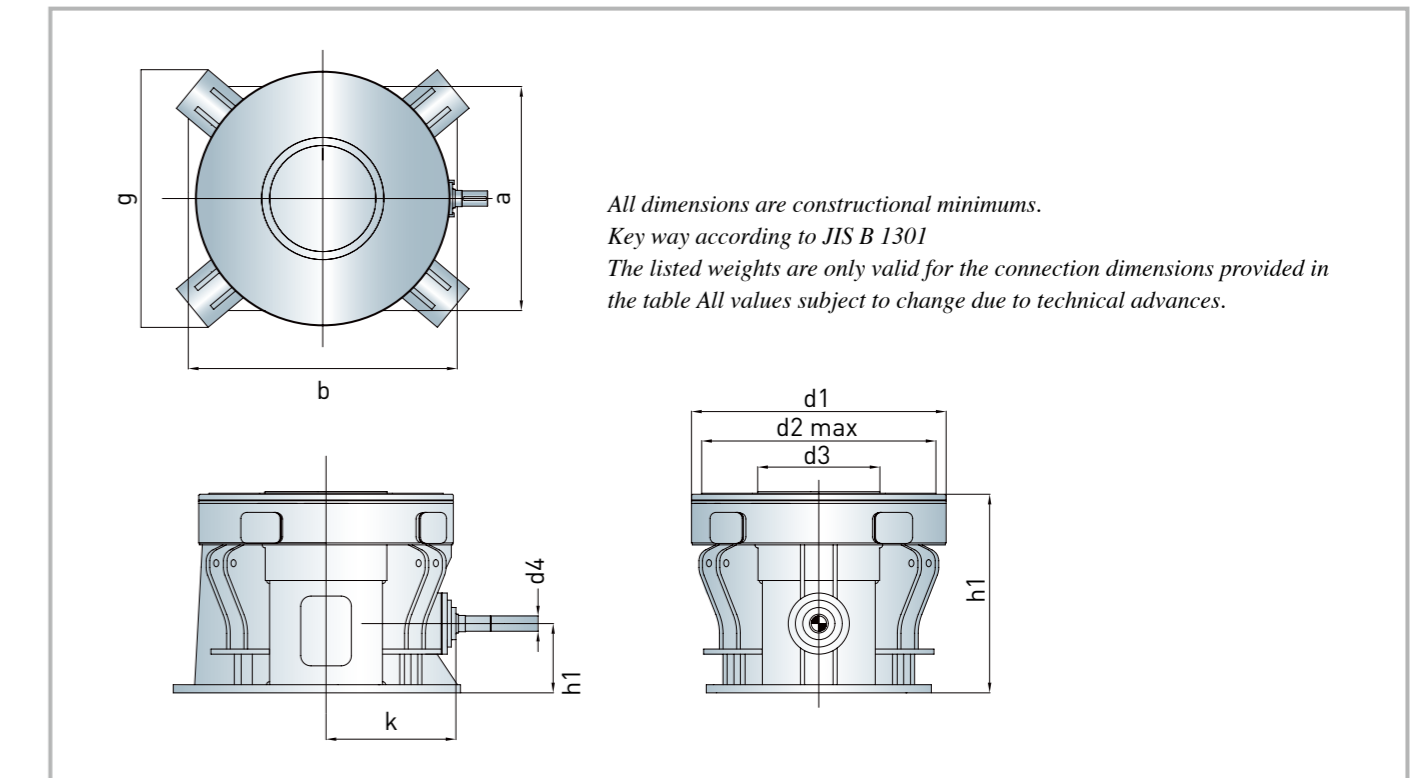
Example

Reusing the same data

$$T = \frac{974 \times 2000 \times 26.76}{990} = 52655 \text{ kgm}$$

The Table uses the AGMA service factor 2.0 The result is the **KPAV 180** gear box.

Pulverizer Dimensions



All dimensions are constructional minimums.

Key way according to JIS B 1301

The listed weights are only valid for the connection dimensions provided in the table All values subject to change due to technical advances.

Gear Unit	size	Housing Dimensions				Connection Dimensions					Weight	
		a	b	g	h1	h2	d1	d2max	d3	k	d4	kg
BPBV	50	950	930		785	260	1,080	940	600	600	60	2,000
	63	1,040	1,020		885	320	1,185	1,045	720	660	65	3,300
	71	1,180	1,160		934	330	1,325	1,205	800	710	75	4,200
	80	1,320	1,300		1,090	385	1,390	1,270	850	760	85	5,400
	90	1,530	1,510		1,110	370	1,625	1,435	1,000	850	90	7,000
	100	1,620	1,600		1,300	420	1,740	1,480	1,000	1,025	100	10,000
	112	1,820	1,800		1,300	420	1,760	1,630	1,000	960	100	10,600
KPAV	140	2,280	2,190	2,460	1,600	530	2,430	2,185	1,450	1,345	120	24,600
	160	2,440	2,500	2,860	1,740	590	2,790	2,500	1,750	1,300	130	32,000
	180	2,720	2,810	3,000	2,140	820	2,900	2,570	1,750	1,450	140	40,000
BPPCV	110	2,400	2,380		2,285	980	2,600	2,350	1,400	1,400	150	
	130	2,700	2,660		2,400	980	2,900	2,500	1,460	1,800	175	
	150	3,070	3,000		2,530	970	3,200	2,660	1,510	2,160	200	
	170	3,500	4,050		3,250	1,380	3,670	3,410	2,250	2,030	220	