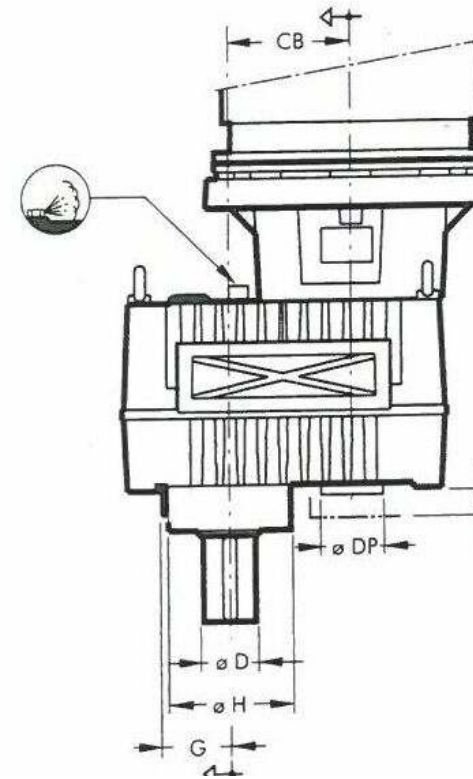


Gear boxes for ACC applications

Gear boxes are used for fan-drives in ACC's
For motor power in excess of 30 kW, or 40 HP, Gear boxes are used
instead of V-belt drives.

With the correct selection and maintenance, the life span of a good gear box is 15 to 20 years, or longer.



Items to be investigated for the selection

The following data must be used to perform a gear-box selection

1. The fan shaft power.
2. Power absorbed during worst conditions e.g. storm
3. Inverter installed and range or DOL
4. Service factor
5. Lubrication
6. Vibrations
7. Temperature min/max

Gear Box Power

The fan shaft power must be given any time
With the service factor selected we get the AGMA Power.
Thermal power, to eject the heat generated inside the gear box.

Sample:

Fan shaft power	75 kW
Motor Power incl. power losses in the gear box and motor	$75 \times 1.1 = 82.5$
Power increase during cold ambient temp.	$82.5 \times 1.1 = 90.75$
Service factor selected	2.2
AGMA Power	$2.2 \times 90.75 = 199.65$
Thermal power	195 kW

Service factor

The service factor is the factor with what the calculated power is multiplied for safety reasons.

This allows for vibrations, extreme conditions, start-up power and wear.

In most cases the selected service factor is between 2 and 3.

Note.

If a frequency inverter is used the service factor can be smaller.

With an inverter start-ups and stops can be controlled with ramping, this eliminates greatly the acceleration and de-acceleration forces .

The service factor is valid for:

- Gears
- Bearings
- Shafts
- Housing

Thermal Power

The thermal power is the heat generated inside the gearbox.

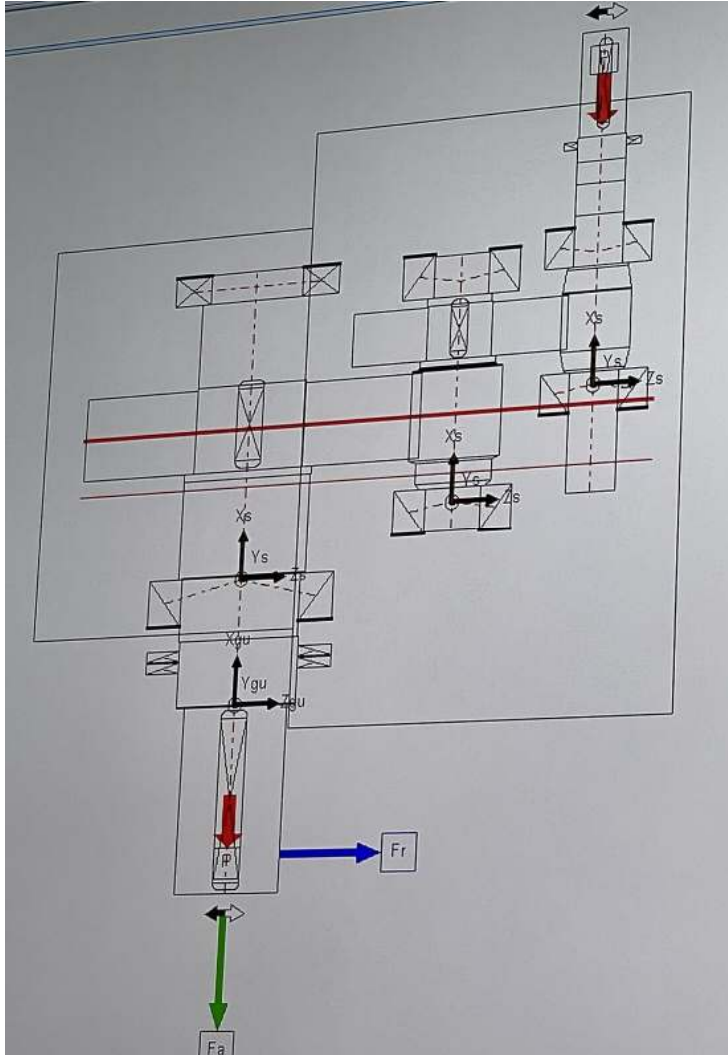
This heat must be transferred to the air flowing around the gearbox.

As the air flowing around the gear-box has a velocity of 1m/sec special care must be given. We must also realise that the air will flow downwards in the center of the fan.

Using an acoustic cover, forced draught cooling must be applied.

Forces in Gear box

The illustration shows the main forces inside the gear box



Selection of gear box

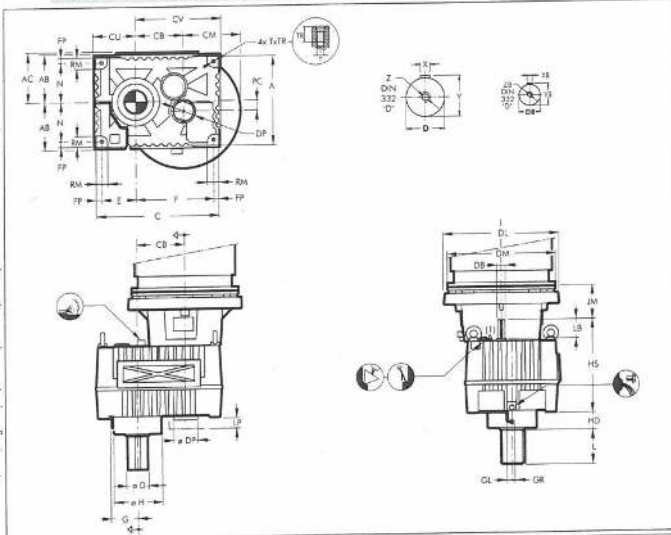
The selection of a gear box has the following steps.

1. Select the ratio, list 1
2. Select the RPM of motor, list 1
3. Select the power, list 1
4. Devide this power listed by selected SF = < motor power
5. Look up the right type in list 2 for dimensions

Sheet 2

HANSEN M4 ACC 97PUD-VP2N4001N3C mm	Gear unit	Réducteur à engrenages	Zahnradgetriebe	Reductor	P
	Vertical low speed shaft	Arbre EK vertical	Langsame Welle: vertikal	Eje lento vertical	V
	Parallel shafts	Arbres parallèles	Stirnräder	Ejes paralelos	P
	Size	Taille	Baugröße	Tamaño	DA ▶ FX
	Two stages	Deux étages	Zweistufig	Dois etapes	2U
Without filter	Sans filtre	Ohne Filter	Sin el filtro		
For air cooled condenser fan drives	Pour commandes des ventilateurs des condenseurs à air	Für Ventilatorantriebe in Luftkondensatoren	Para las impulsiones del ventilador de los condensadores de aire		

The user is responsible for the provision of safety guards and correct installation of all equipment.
Certifié et homologué pour le Québec.
Las características de protección deben ser las indicadas en el manual. El cliente es responsable de la formación correcta de la instalación.
Dimensionen definiert die Bauweise.
Der Benutzer ist verantwortlich für die Beschaffung der Schutzvorrichtungen und die korrekte Ausführung der Anordnung.
Verbinden Abtriebe nur auf Wunsch.
El usuario es responsable del equipamiento de seguridad y de la correcta instalación de los componentes.
Ficha de dimensiones en milímetros.



UDN

Shaft arrangements Dispositions des arbre (voir de face) Wellenanordnungen (Nebenansicht) Disposición de ejes (visto frontal)

(1) Certified version only.
(2) Pair of gears only.
(3) Zero backlash.
(4) Pair of keys.

Type	A	AB	AC	C	CB	CU	CV	E	F	FP	G	GL	GR	H	HD	HS	N	RM	Y	TR	kg	Litres
PVPDA2U	590	315	335	770	281	250	550	190	500	40	170	50	20	290	141	695	255	85	M30	53	750	28
PVPDX2U	600	315	335	645	323	285	593	225	530	45	185	50	20	315	141	695	255	85	M30	53	820	31
PVPEA2U	570	350	365	850	321	285	600	220	540	45	190	50	20	330	156	735	290	90	M30	53	950	32
PVPEX2U	570	350	365	925	358	320	640	255	580	45	205	50	20	365	156	735	290	90	M30	53	1060	35
PVPFA2U	720	375	390	920	364	315	640	240	570	55	210	50	20	375	111	820	305	105	M36	64	1320	47
PVPFX2U	720	375	390	1015	406	360	690	285	620	55	210	50	20	375	111	820	305	105	M36	64	1430	54

Type	Shafts - Arbres - Wellen - Ejes				Keys - Clavetas - Schlüssel - Chavetas				DIN 6885-T1				Pump - Pompe - Pumpe - Bomba				Motor - Moteur			
	D-m7	L	X	Y	Z	DB-m6	LB	XB	YB	ZB	DP	LP	PC	IEC	DM	DL	CM	JM		
PVPDA2U	11.5	210	32	122	M24	58	145	16	62	M20	150	65	40	250	550	710	355	145		
PVPDX2U	135	290	36	143	M30	58	145	16	62	M20	150	65	38	280	550	710	355	145		
PVPEA2U	135	290	36	143	M30	63	145	18	69	M20	150	65	68	315	660	710	355	175		
PVPEX2U	155	290	40	164	M30	65	145	18	69	M20	150	65	74	355	800	850	425	215		
PVPFA2U	175	300	45	185	M30	75	145	20	79.5	M20	150	65	91							
PVPFX2U	175	300	45	185	M30	75	145	20	79.5	M20	150	65	93							

Lubrication

Lubrication could be with mineral oil or synthetic oil.

- Mineral oil does have an temperature range smaller that synthetic oil.
- Also mineral oil will wear faster that synthetic oil.
- For this reason we mostly advice to use synthetic oil.
- For most applications with a ambient temperature range of -15 to 40 C synthetic oil ISO VG 220 can be used.
- For locations with a different temperature range ISO VG 320 or ISO VG 150 can be used.



Humidity in oil

One of the most important measures to protect the gear box is preventing humidity (water) to be mixed with the oil.

As the gearbox is subject to different temperatures, outside air, with humidity or vapor, can enter the gear box.



Water in the oil can make micro welds on the teeth of the gears.

This can create pit wear and damage to the gears and especially the bearings (less contact surface).

Suitable Silicagel filters must be used to dry the incoming air.

Vibrations

Vibration are always present.

The fan is a rotating device with mostly a small unbalance.

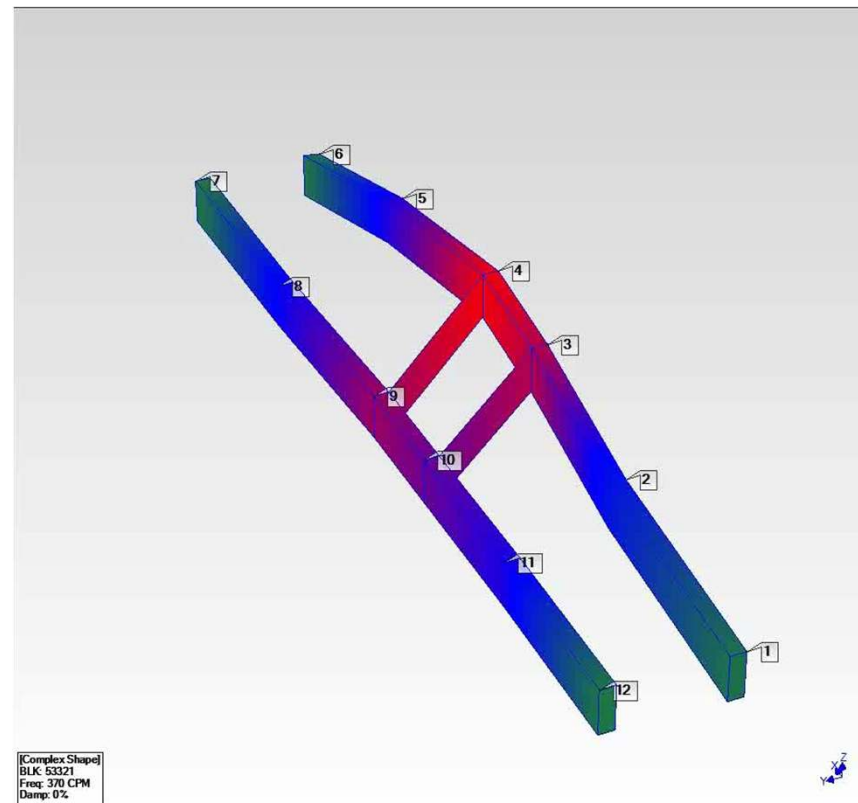
To get rid of all the unbalances is virtually impossible, there will always be a small unbalance present.

A small vibration is no problem as long as the frequencies are not near the own frequency of the stucture.

This is applicable for:

- The fan bridge
- Steel support structure.

Deformations of fan bridge



Allowable Vibrations

Diagram for allowable bearing stresses

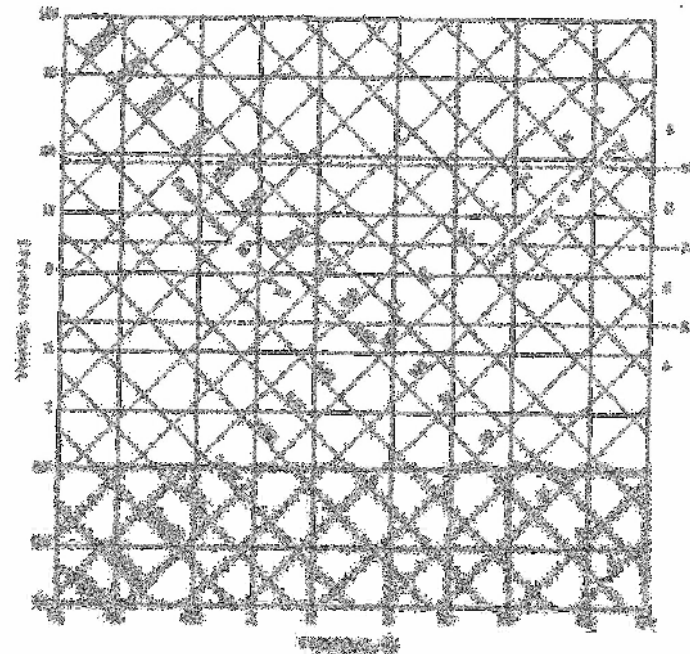


Diagram for allowable bearing stresses



Thank you for your attention

For more information,

You can contact ACC Team, mail huubh@acc-team.com