



# SWEDFAN

Swedish Underground Ventilation

## Mining and Tunnelling Fans Flexible Ducting



**” Your supplier of a turnkey ventilation system  
for underground works since 1995 ”**

- High-pressure tunnelling fans
- Flexible ventilation ducting
- Dust collectors
- Cooling systems
- Ventilation system design
- Project supervision

# Mining and Tunnelling Fans



## SWEDFAN Mining and Tunnelling Fans

### The impeller

A large hub, short blades and small gap between the blades and fan casting result in the capability of the fans working against very high system pressures. The impellers rotate towards specially designed guide vanes eliminate swirl and turbulence. This fact and the extreme twist of the blades contribute to the efficiency and the low sound levels.



### Heavy duty construction

SWEDFAN Mining and Tunnelling Fans are made in very robust and heavy duty design with fully welded flanges. The anti-rust protection is designed for withstanding acid and aggressive environments.

### Adjustable air flow

The impellers consist of hub of steel or aluminium and individually adjustable blades of aluminium. The possibility of changing the blade angle gives the advantage of using the same fan for a number of different tunnel conditions. E.g.a.  $\varnothing$  1250 mm fan can be set to deliver from  $\approx 16$  m<sup>3</sup>/s to  $\approx 44$  m<sup>3</sup>/s. An additional advantage is that only the blades need to be changed when the impellers are overhauled. The impellers are statically and dynamically balanced.

### Made in Sweden

The fans are manufactured in Sweden. In cooperation with both domestic and international research institutes, a continuous development work is carried out.

The aim is to further increase the efficiency, increase the capability of the fans delivering air at higher system pressures, further lower the sound levels and to improve the automatic controlled ventilation.

### Highly efficient silencers

Our standard silencer are manufactured with mineral wool as absorbing material. For high efficient noise reduction, the silencers are provided with a centre core filled with mineral wool which efficiently also reduces the high frequency sound. Casting is made from 3 or 4 mm steel, depending on size. Anti-rust protection preformed as for fan casting. Silencers are a safe protection against slinter if a fan should burst.

# Mining and Tunnelling Fans



**“High pressures,  
low energy consumption,  
low sound levels”**

## Starters

SWEDFAN offers three main types of starters.

Direct starters, Dahlander starters (for two-speed motors) and Frequency inverters. Depending on the logistics of the tunnelling job SWEDFAN evaluates which type of starter will give the lowest energy cost and recommends which of the three types will be most suitable.



## Motor

SWEDFAN Mining and Tunnelling Fans are equipped with ISO classified high quality motors. Lubrication of motor bearings is done from outside the casing. e motors are labelled with individual serial numbers for future search of spare parts etc. Thermistors are mounted directly onto the motor windings for sensing the heat of the winding. A reduced cooling of the motors (due to dirt on the cooling ribs etc) will not burn out of the motors, provided that thermistors are connected to monitoring or shut-down devices. **Great experience.**

SWEDFAN System Design uses calculations based on in situ measurements from more than 600 different tunnelling jobs.

SWEDFAN makes calculations using PC-supported software and the calculations are presented as calculation sheets showing project specific data. Total leakage is presented as “leakage factor“ which states how much more air that has to be delivered from the fan compared to the amount of air delivered at the heading.



To date SWEDFAN can show a great number of major tunnelling projects where SWEDFAN made the ventilation system design with fully satisfactory ventilation during the entire project.

## QUALITY CONTROL

SWEDFAN works according to the quality system ISO 9001 and the fans are delivered with CE marking affixed. Every fan is tested before delivery and accompanied by a test report with the capacity curve drawn.

## REGULATED VENTILATION

For optimized energy saving and varied air flow, SWEDFAN Mining and Tunnelling Fans can be provided with the following two alternative solutions for adjusting the air flow as the fans are running:

- Two-speed or multi-speed fan motors.
- Frequency inverters.

## WHY SYSTEM DESIGN?

The system design aims at choosing the equipment which together with the energy cost gives the lowest total cost for the ventilation during the project.

The important part of the system design is the ventilator calculation which give following answers, necessary for choosing fans and ducting:

- Max system pressure
- Total leakage
- Lowest necessary air flow to comply with regulations regarding diesel equipment and personnel in the tunnel.

- Max motor load
- Energy consumption

## LARGE CAPACITY RANGE

SWEDFAN Mining and Tunnelling Fans are manufactured in many different diameters and capacities, from Ø630 to Ø2240 mm and from 1.5 to 200 m<sup>3</sup>/s. The fans can withstand a system pressure of up to 4200 Pa per stage. At higher system pressures two or more fans are mounted in series into one multi-fan station.

## ADDITIONAL ACCESSORIES

- Inlet bells
- Outlet diffusers
- Connection flanges for flexible duct
- Mounting frames
- Air flow measuring devices
- Vibration alarms



**SWEDFAN**  
Swedish Underground Ventilation


## High pressure tunnelling & mining fans with accessories - technical specification

FAN MODEL	AVH-R63	AVH-R71	AVH-R90	AVH-R100	AVH-R112	AVH-R125	AVH-R140	AVH-R160	AVH-R180	AVH-R200	AVH-R230	
Motor	F-class, IP54, 400/440 V, 50/60 Hz											
Motor support	Flange mounted											
Nominal power	9-25 kW	11-37 kW	37-90 kW	45-110 kW	9-37 kW	45-160 kW	45-160 kW	75-315 kW	132-500 kW	132-500 kW	250-710 kW	
Impeller speed	3000/3600 rpm				1500/1780 rpm				1000/1200 rpm	1000/1200 rpm		
Bearings	SKF											
Bearing lubrication	SKF "auto-lubricators system 24" on casing outside											
Impeller hub	Ø300 mm, cast aluminium	Ø430/510 mm, cast steel		Ø510/560 mm, cast steel		Ø600 mm, cast steel		Ø970-1250 Ø800 / 900 / 1000 mm, cast steel mm, welded steel				
Impeller blades	4-12 pcs, cast aluminium, adjustable at stillstand											
Gap between blade top and fan casing	1,2 mm	1,2 mm	1,2 mm	1,2 mm	1,5 mm	1,5 mm	1,5 mm	2,0 mm	2,0 mm	2,5 mm	3,0 mm	
Casing inner Ø	630 mm	710 mm	900 mm	1000 mm	1120 mm	1250 mm	1400 mm	1600 mm	1800 mm	2000 mm	2300 mm	
Fan casing thickness	5 mm	6 mm	6 mm	6 mm	6 mm	6 mm	6 mm	8 mm	10 mm	10 mm	12 mm	
Casing anti-rust protection	140 µ epoxy + polyurethane											
Casing flanges	laser-cut, 10x60 mm, welded			laser-cut, 10x70 mm, welded		laser-cut, 10x80 mm, welded		laser-cut, 10x100 mm, welded	laser-cut, 10x120 mm, welded			
Turbulence elimination	Guide vanes welded to inside casing + straight longitudinal "fins"											
CE-marking	yes											
Performance test	Full test before delivery incl. capacity measurements. Test made <b>together with frequency inverters</b> should such be included in the delivery.											
Allowed vibrations	ISO 1940 Level G4											

FANS

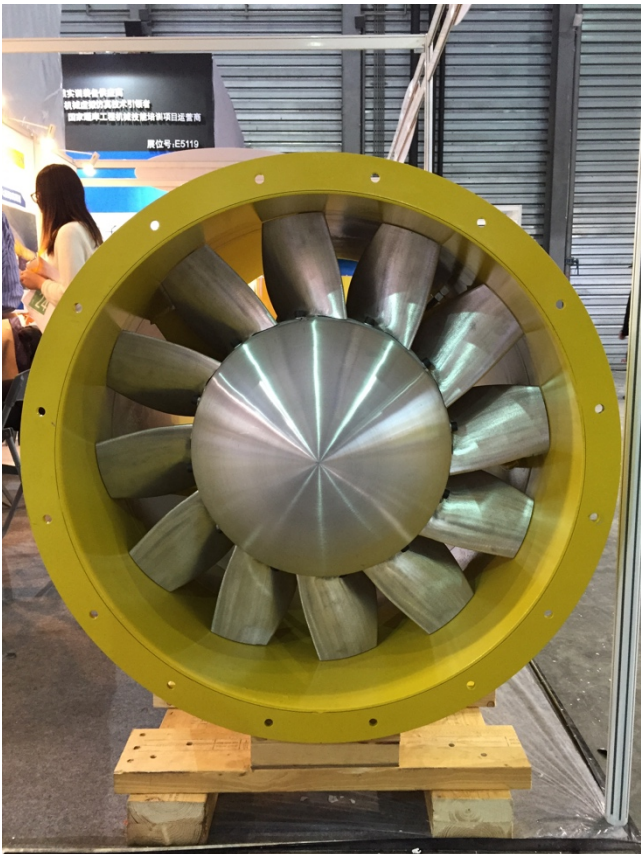


SILENCERS	MODEL	GS63	GS71	GS90	GS100	GS112	GS125	GS140	GS160	GS180	GS200	GS230
	Inner Ø	630 mm	710 mm	800 mm	1000 mm	1120 mm	1250 mm	1400 mm	1600 mm	1800 mm	2000 mm	2300 mm
	Outer Ø	778 mm	858 mm	1088 mm	1188 mm	1308 mm	1438 mm	1628 mm	1828 mm	2028 mm	2228 mm	2528 mm
	Length	750 mm	1000 mm	1250 mm	1500 mm	1500 mm	2000 mm	2000 mm	2400 mm	2400 mm	2400 mm	3000 mm
	Casting flanges	lasercut, 8x70 mm, welded		lasercut, 8x90 mm, welded			lasercut, 8x110 mm, welded					
	Casing thickness	3 mm										
	Sound absorbing material	Heavy mineral wool 70mm		Heavy mineral wool 95mm			Heavy mineral wool 120mm					
	Self supporting to fan casting	yes										
	Casting anti-rust protection	140 µ epoxy + polyurethane										
	"Super silencer"	centre baffle, l=silencer-50 mm, Ø380 mm					centre baffle, l=silencer -50 mm, Ø650 mm			centre baffle, l=silencer -50mm, Ø800 mm		

INLET BELLS	MODEL	GIB63	GIB71	GIB90	GIB100	GIB112	GIB125	GIB140	GIB160	GIB180	GIB200	GIB230
	Intake	"Bell shaped", pressure turned										
	Casing thickness	3 mm										
	Protection grille "spider net model"											

DUCT ADAPTERS	MODEL	GIB63	GIB71	GIB90	GIB100	GIB112	GIB125	GIB140	GIB160	GIB180	GIB200	GIB230
	Length	150 mm	150 mm	150 mm	150 mm	150 mm	150 mm	200 mm	200 mm	200 mm	200 mm	200 mm
	Casting thickness	3 mm										
	Casing thickness	Ø8 mm ring welded to adapter end for securing ducting										

FREQUENCY INVERTERS	Nominal power	11-710 kW										
	Power supply	400/440 V, 50/60 Hz										
	Adjustable fan speed	250 rpm up to full speed										
	Protections	motor current, short circuit, phase failure, over- and under voltage										
	Operation controls	LED-display with control buttons mounted on outside casing door										
	Cooling	By cooling fan										
	Capsuling	IP 54										
	Standard extra protection	All circuit boards laquered for protection against moisture and dust										
	CE-marking	yes										
	Others	The inverters fulfil the EU-regulations for start of electrical equipment										
	Optional	Inverters built in an IP54 cabinet. Circuit breaker, automatic fuses, cabinet heater are also optional.										
Optional	EMC-filter											



**SWEDFAN Flexible Ducting is manufactured from PVC-coated polyester fabric and is distinguished by the relatively low weight with kept high strength values which results in a very pliable and easy to handle duct.**



## SWEDFAN Flexible Ducting

### Diameter and Quality Standard

SWEDFAN Flexible Ducting is manufactured in diameters from 300 up to 3000 mm and in unit lengths from 10 m up to 200 m. All fabric joints are vulcanized 40 mm wide. Every unit length is marked with information regarding diameter, unit length, quality, max allowed working pressure and manufacturing date.

SWEDFAN Flexible Ducting is manufactured in two different standard qualities and in two antistatic qualities which all fulfil the following Flame Retardant standards DIN 4102-B1, MSHA and EN13501-1 regarding fire resistance.

### Rip-stop

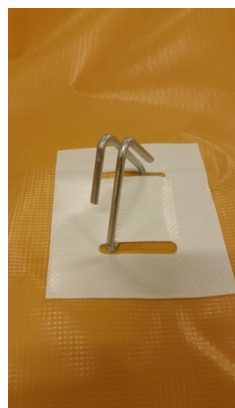
Every inch, the base fabric is made with an enhanced yarn which dramatically increases the tear strength. This feature eliminates the ducting to further-tear longitudinally under normal conditions.

### Coupling: Steel clamps

Every flexible ducting is manufactured with a steel ring vulcanized in one or both ends of every unit length. The outer diameter of the steel ring is equivalent to the nominal diameter of the duct.



The unit lengths are connected together by pulling the end of one duct over the end with steel ring of next duct. Around the joint, a SWEDFAN coupling clamp is positioned. The coupling clamp is made of 1.5 mm profiled galvanized steel with mounted threaded crank. The joint is sealed by tightening the coupling clamp using the threaded crank..



### Coupling: SWEDFAN ZIP-joint

Both duct ends are fitted with a split zipper of heavy duty PVC-type. The protection-flap hides the zipper on the outside and seals the joint on the inside, according to the principle “the higher pressure the tighter joint”.

The ZIP-joint eliminates the coupling clamp and steel ring at the duct end. With the ZIP-joint the ducting is delivered on standard pallets 1200 x 800 mm.

This is the standard coupling system of SWEDFAN ducting

### Suspension system

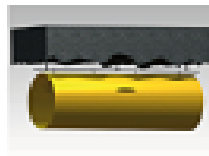
The ducting, as standard, is delivered with mounted suspension hooks c/c 0.75 m in one line (from Ø 300 to Ø 1700 mm) and c/c 1.0 m in two parallel lines (from Ø 1800 to Ø 3000 mm).

Every hook is fixed to the duct by a fabric “strap” which is vulcanized to the duct. This construction eliminates holes in the fabric which would break the armour and weaken the construction (compare “eyelets”). Further, this construction also eliminates the common longitudinal continuous suspension “flap” with eyelets which also contributes to keeping the duct pliable and the weight low.

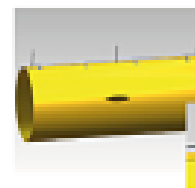
# Flexible Ducting

## SWEDFAN Repair Sleeve

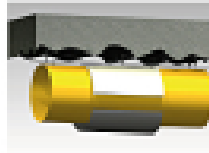
The repair sleeve is a fast and secure tool for repairing holes and tears of flexible ducting. The sleeve is made from standard duct material and a longitudinal zipper is attached for closing the sleeve. The sleeve is made approx. 0.5% smaller than the nominal duct diameter which will allow the sleeve to be really tight against the duct once the duct is pressurized. With the repair sleeve, the repair will be professionally done and the leakage from any hole will be reduced to a minimum. The repair sleeves are manufactured in standard lengths 1.0, 2.0, 3.0 and 5.0 m. Other lengths will be manufactured upon request.



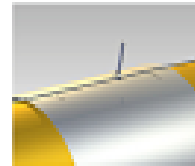
1. Determine the length of the hole. The repair sleeve should cover the hole with at least 0.5 m margin.



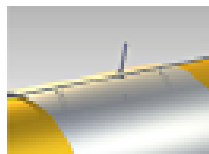
2. Unhook the suspension hooks which will be covered by the repair sleeve.



3. Wrap the repair sleeve over the duct. Make sure the hole is well covered by the sleeve and the zipper is at least 0.5 m away from the hole.



4. Cut a hole in the repair sleeve for each suspension hook using a knife.



5. Pull the suspension hooks through the holes and hook them back onto the suspension cable.



6. Close the zipper and the repair is finished.

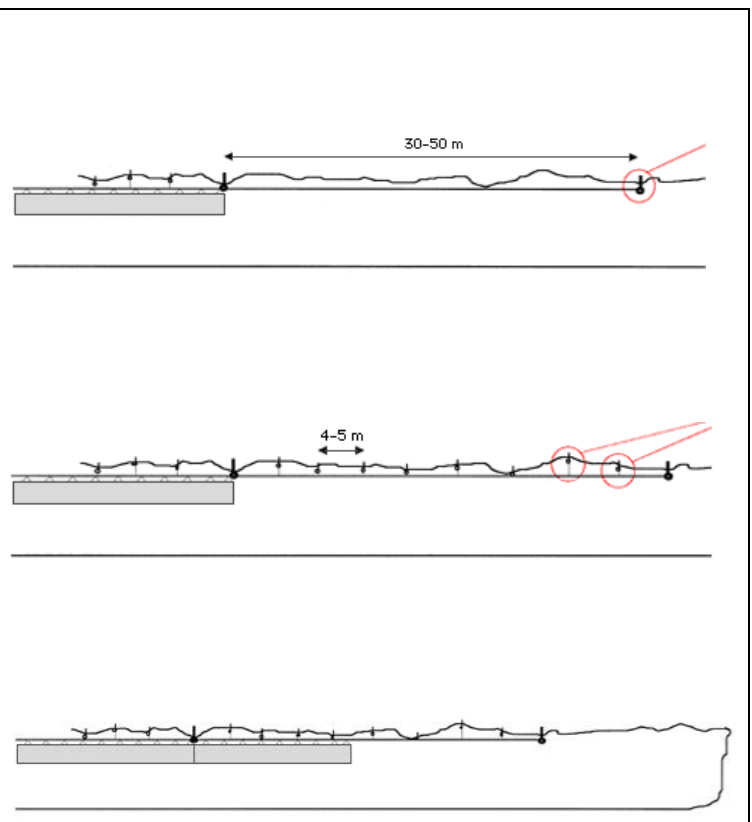
## Ducting Mounting Instruction SWEDFAN Flexible Ducting

### STARTING POSITION

New wire rope is to be mounted. At a distance of 30–50 m from the end of the previously mounted wire rope, a steel bolt Ø20-24 mm is mounted at a “low” point in the tunnel ceiling. Secure the wire rope (an Ø6-8 mm galvanized steel wire rope) at each end to the Ø20-24 mm steel bolt using wire rope clips. Tighten the wire rope properly using a wire rope lightener.

After the new wire rope is installed, place at a distance of 2-3 m a smaller steel bolt Ø5-10 mm drilled by “hand-held” drilling machine along the wire rope. Use a 2–3 mm galvanized steel wire between the Ø5-10 mm steel bolt and the wire rope without changing the horizontal alignment of the wire rope.

Suspend the flexible ducting to the wire rope using the suspension hooks vulcanized to the ducting.





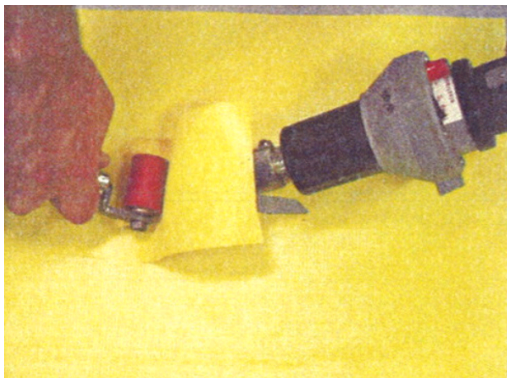


## SWEDFAN Repair Kit

Including Hot Air Gun with roller and 1 sqm of PVC material for repairing the damaged Ducting.



Always have a clean and dry fabric to work on.  
Repairing with the Hot Air Gun is the professional way to repair ducting. The result is optimal durability of a repaired damage and no leakage. When using Hot Air Gun, always have something direct under the area you are repairing!  
It's very hot, be careful when using it and protect yourself!





## Flexible Ducting - Technical specification

**General:** All seams and other joining works are fully welded (vulcanised) 40 mm wide. No sewing. Suspension hooks are welded to the fabric at a distance of c/c 0,75 m. On duct diameters >Ø1800 mm, two parallel lines of suspension hooks are mounted, standard radial distance between the two lines 1,20 m.

**Coupling A1 - ZIP-joints and A-2 VELCRO:** Both duct ends made with a split zipper (plastic zipper) of heavy duty PVC-type or VELCRO.

**Protection-sleeve** which on the outside hides the zipper/VELCRO and on the inside seals the joint according to the principle "the higher pressure the tighter joint". With ZIP/VELCRO-joints, the ducting is delivered on standard pallets regardless diameter.

**Coupling B - Steel clamps:** One end of each duct length is fitted with a steel ring, vulcanised to the fabric. One steel clamp made of galvanized 1,5 mm steel with locking device (threaded crank) closes the joint.

Every duct length is marked with information regarding quality, length, diameter, max allowed working pressure and manufacturing date.

* "RS" stands for Rip-Stop. The base fabric is made with an enhanced yarn which dramatically increases the tear strength. This feature eliminates the ducting to further-tear longitudinally under normal		Titan FR-RSX* (yellow)	Airolite FR-RSX* (yellow)	Ultralite FR (yellow)	Titan FRA-RSX* (black)	Airolite FRA-RSX* (black)
<b>Base fabric</b>		Polyester				
<b>Yarn thickness weft/warp (dtex)</b>		2200/1430	3300/1100	1100/940	2200/1430	3300/1100
<b>Coating</b>		Flame retardant plasticized PVC				
<b>Tensile strength (N/100 mm) DIN EN ISO 1421:1998 (x)</b>	<b>warp</b>	3200	2500	1900	3200	2500
	<b>weft</b>	4800	2800	2100	4800	2800
<b>Tear strength (N/100 - crack 20 mm) TTT867007:1987 (xx)</b>	<b>warp</b>	1400	1100	900	1400	1100
	<b>weft</b>	1650	1250	950	1650	1250
<b>Total weight (gram/m2) (DIN 53352)</b>		600	500	350	600	500
<b>Flame resistance (DIN4102-B1 + MSHA + EN 13501-1)</b>		Meet all three. EN13501-1 as B-s1,d0 (s1=low smoke, d0=no flaming droplets)				
<b>Cold crack (DIN 53361)</b>		-30°C				
<b>Environmental resistance</b>		Resistant against rotting, humus acid, diesel- and nitrous gases, UV-light				
<b>Conductivity (ISO 284)</b>		-----	-----	-----	1x10 <sup>10</sup> Ω	1x10 <sup>10</sup> Ω
<p>(x) = Tensile speed 2mm/minute = creep test = very low speed compared to conventional tensile tests.            Length of loaded sample 600mm and width of sample 100mm.            Standard Tensile Test: speed 100mm/minute, length of loaded sample 200mm and width of sample 50mm.            (xx) = Tensile speed 2mm/minute = creep test = very low speed compared to conventional tear tests.            Length of loaded sample 600mm. Width of sample 100mm and width of crack 20mm.</p>						

Diameter (mm)	Max allowed working pressures (kPa) valid for new ducting. Safety factor 2,5.	Titan FR-RSX*	Airolite FR-RSX*	Ultralite FR	Titan FRA-RSX*	Airolite FRA-RSX*
400		98,0	64,4	48,3	98,0	64,4
500		78,4	51,5	38,6	78,4	51,5
600		65,3	42,9	32,2	65,3	42,9
700		56,0	36,8	27,6	56,0	36,8
800		49,0	32,2	24,2	49,0	32,2
900		43,6	28,6	21,5	43,6	28,6
1000		39,2	25,8	19,4	39,2	25,8
1100		35,6	23,5	17,6	35,6	23,5
1200		32,7	21,5	16,1	32,7	21,5
1300		30,2	19,8	14,9	30,2	19,8
1400		28,0	18,4	13,8	28,0	18,4
1500		26,1	17,1	12,8	26,1	17,1
1600		24,5	16,1	12,1	24,5	16,1
1700		23,1	15,2	11,4	23,1	15,2
1800		21,8	14,3	10,7	21,8	14,3
2000		19,6	12,9	9,7	19,6	12,9
2200		17,8	11,7	8,8	17,8	11,7
2400		16,3	10,7	8,0	16,3	10,7
2500		15,7	10,4	7,8	15,7	10,4
2600	15,1	9,9	7,4	15,1	9,9	
2800	14,0	9,2	6,9	14,0	9,2	
3000	13,1	8,6	6,5	13,1	8,6	

Note: All specifications are subject to changes without notification.

## SWEDFAN BRANCH PIPES, standard

Made of PVC coated fabric Titan FR-RS, suspension hooks on both upper and lower side.

## SWEDFAN BENDS, standard

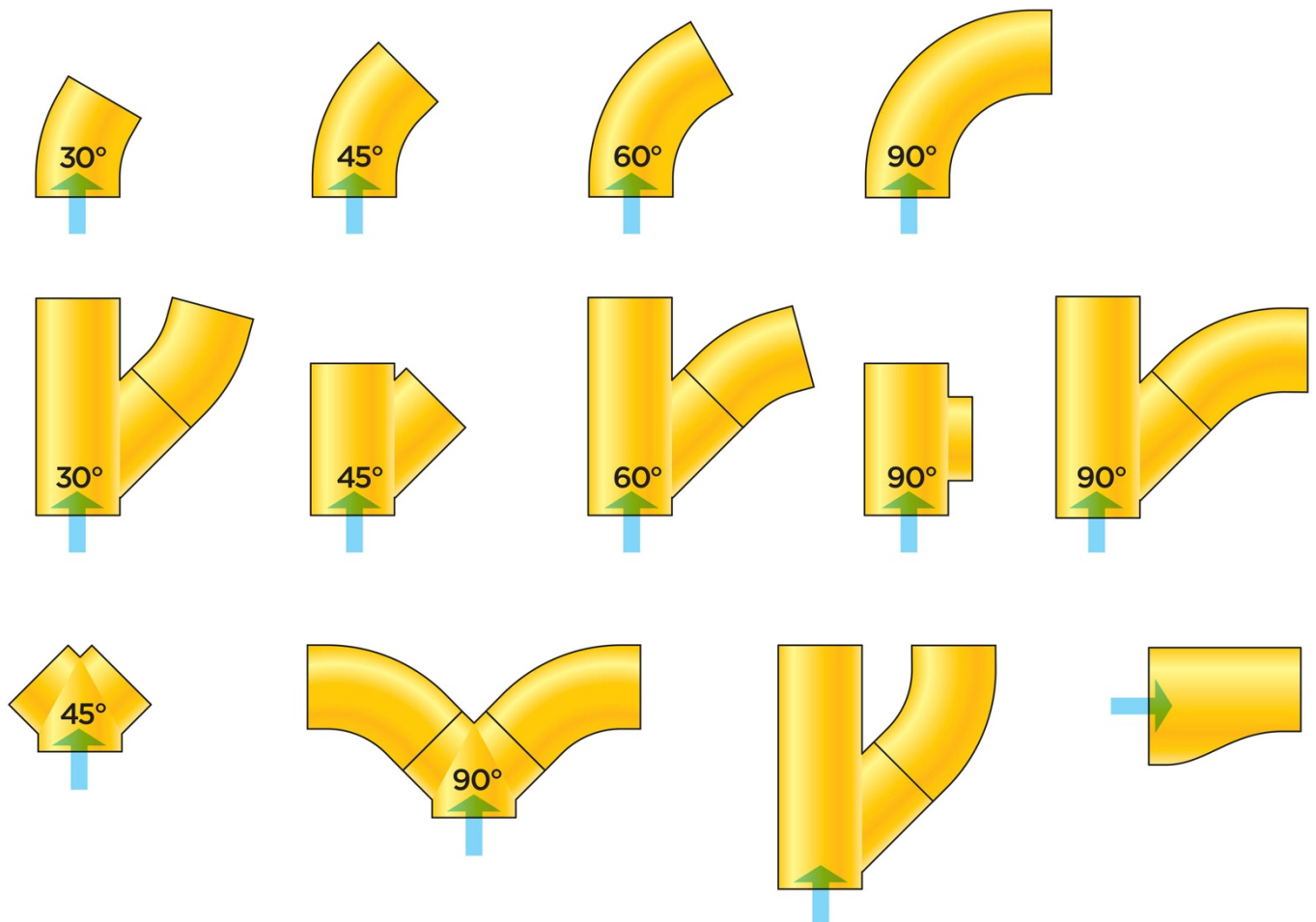
Made of PVC coated fabric Titan FR-RS, suspension hooks on upper side.

## SWEDFAN Y-BRANCH, standard

Made of PVC coated fabric Titan FR-RS, steel ring in all ends, suspension hooks on upper side.

## SWEDFAN CONE PIPES, standard

Made of PVC coated fabric Titan FR-RS, steel ring in all ends, suspension hooks on upper side.



## How to reduce energy consumption using frequency controlled fan in drill & blast tunnelling projects.

By the use of frequency inverters to control/start a fan, the fan speed can be set to any from 0 to full speed. This is achieved by the function of the inverter which outputs a frequency of 0-300 Hz. Normally, the output from the frequency inverter for a tunnelling fan is 10-60 Hz. Lower than 10 Hz, the cooling of the fan motors can be too low and higher than 60 Hz, the strain on the fan impeller starts to be too high.

Example: if the fan speed is 1500 rpm at 50 Hz, with the frequency reduced to 25 Hz, the fan speed is 750 rpm. The incoming power to the frequency inverter is always determined by the local electric grid, 50 Hz for some countries, 60 Hz for other.

The power load on a fan is in relation to the fan speed by cubed. Example: if a fan is running at full speed 1500 rpm and the power load is 100 kW, with the fan is running at half speed 750 rpm, the theoretical power load is 12,5 kW. A reduction of 87,5 kW! Since there are some energy losses in the frequency inverter composed mostly of heat, the practical power load at half speed is 15% compared to full speed, saving of 85%.

The airflow delivered by the fan is linearly in relation to the fan speed which means at half speed, the airflow is half compared to full speed.

In a drill & blast tunnel, normally, several works do not require so much airflow which means when those works are going on, the fan speed should be reduced. Those works are scaling, drilling, charging etc. Normally, the drill & blast tunnelling can be described as following "cycle": It starts with blasting. After blasting, mucking out the blasted rock starts. After the mucking is finished, scaling starts and after that, drilling and charging.

Swedfan's recommendation for max energy saving is following:

immediately after the blast, the fan is started and run at full speed in order to ventilate the blasting fumes out quickest possible. (this normally takes 20-40 minutes)

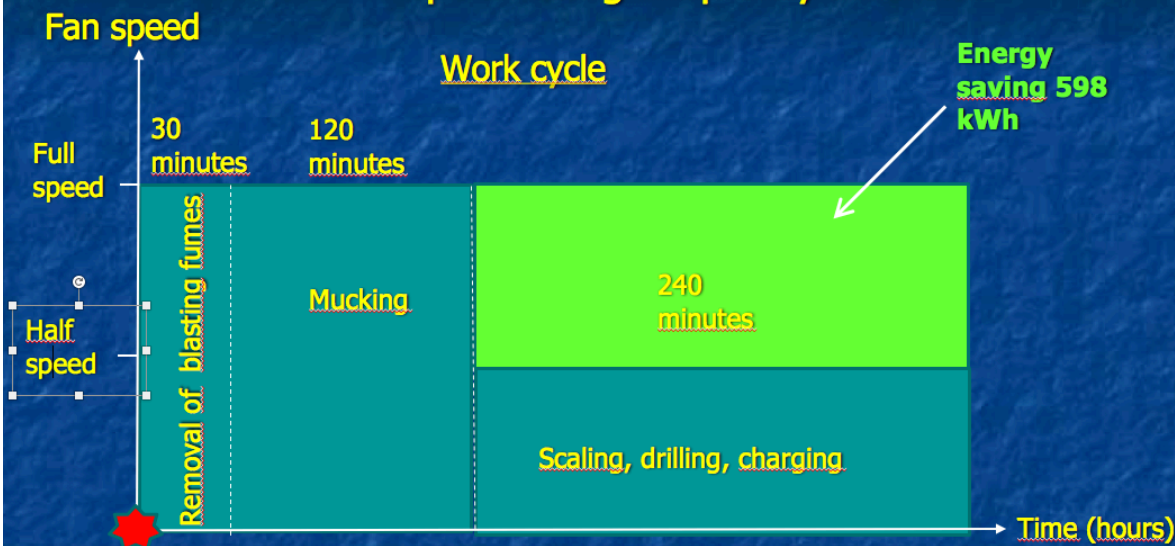
After the blasting fumes are out, the mucking commences and also during this event, the fan is run in full speed since normally, a large amount of diesel fumes from trucks and loaders is polluting the air. (this normally takes 90-150 minutes)

After the mucking is completed the scaling, drilling and charging takes place and for these works, the fan speed is reduced to half speed. These works totally takes 180-240 minutes.

With the Swedfan experience, supplying ventilation systems to the international tunnelling market since 1990, our feedback from hundreds of tunnelling projects using drill & blast show that normally, the fan can be used 50-60% of the total construction time running at half speed. Considering that the fan is consuming only 15% running at half speed, 85% energy saving is possible for 50-60% of the tunnelling period.

In most tunnels, the energy cost saving using the above described method saves money exceeding the investment cost of both fans and ducting for the same project!

## Example: fan 2x110 kW with adjusted speed using frequency inverters



Energy consumption with fan 100% full speed: 6,5 hours x 220 kW x 80% = **1.144 kWh**

Energy consumption with fan running 50% full and 50% half speed: (2,5 hours x 220 kW x 80%) + (4,0 hours x 220 kW x 80% x 15%) = **546 kWh**

### What does this mean in terms of money?

Energy consumption with fan 100% full speed: 6,5 hours x 220 kW x 80% = **1.144 kWh/6,5 hours**

Energy consumption with fan running 50% full and 50% half speed: (2,5 hours x 220 kW x 80%) + (4,0 hours x 220 kW x 80% x 15%) = **546 kWh/6,5 hours**

Energy saving per hour = **546 kWh/6,5 hours = 84 kw/hour**

For a two year project where the power cost is 0,15 USD/kWh, this results in 15.000 hours x 0,15 USD x 84 = **189.000 USD**



# Mining and Tunnelling Fans

Reference list ventilation design performed by Bo Stromsholm,  
SWEDFAN Internationals AB & fans delivered



Customer	Project	Country	Year	Delivered fan type	Qty
CRCC B18	Yanjiabao	CN	2015	AVH-R140.110	2
CRTG B12	Hangqian tunnel	CN	2015	AVH-R125.90	4
CRTG B18	Qianzhangchang	CN	2015	AVH-R140.132	3
Sino Hydro B8	Hangqian tunnel	CN	2015	AVH-R125.75	5
CRTG B18	Hangqian tunnel	CN	2015	AVH-R125.75	6
Samho	Ulsan Tunnel	KR	2015	AVH-R160.160	4
Dogus Insaat and Ticaret A.S.	Riyadh Metro	SA	2015	AVH-R140.160	4
CGGC/ Sino Hydro	Baihetan	CN	2013-2014	AVH-R90.75 AVH-R140.132 AVH-R160.160 AVH-R180	110
Alfred Kuntz	Schwarzkopftunnel	DE	2014	AVH-R180.250	2
Cosapi/Maz Errazuriz	Quellaveco	PE	2014	AVH-R160.250	2
Odebrecht	Lauca, Angola	BR	2014	AVH-R180.250	4
Well Connected JV (McConnell Dowell/Obayashi/Fletcher)	Waterview	NZ	2013	AVH-R63.18 AVH-R125.55 AVH-R180.315	4
CGGC	Laos	CN	2013	AVH-R90.75.2.8	6
CGGC	Qirehatar	CN	2013	AVH125.75.4.8	6
CCCC Ltd	Zhuhai-Macau-Hong Kong immersed tube tunnel	CN	2013	AVH160.250.4.10	2
Jardine Engineering	Bangkok MRT	TH	2012	AVH90.55.2.8	3
Polymetal	Maskoy Mine	RU	2012	AVH180.500.4.10	2
Astaldi Gülermak JV	Metro Warsaw	PL	2012	AVH90.90.2.8	4
Astaldi GyM JV	St Teresa HEPP	PE	2012	AVH125.132.4.8 AVH125.90.4.8	5 2
Veidekke		NO	2012	AVH160.200.4.10	1
Polymetal	Mine	RU	2012	AVH125.110.4.8	9
Gammon	WIL Hong Kong	HK	2012	AVH125.55.4.8	1
Pizzarotti Israel J.V.	Tel Aviv Railway	IL	2012	AVH160.160.4.10	4
Sino Hydro No. 14	Coca Codo Sinclair	CN/EC	2012	AVH160.200.4.10	3
McConnel Dowell	Abu Dhabi	UAE	2012	AVH63.9.2.8	4

For complete reference list please visit our webpage [www.swedfan.se](http://www.swedfan.se)

# CGGC / Sion Hydro Baihetan Project China



- Designed by Bo Strömsholm Swedfan.
- 110 Fans delivered
- 150 000 meter of Ducting in diameter 2000 mm
- SWEDFAN International has received an award from the Ministry in Beijing for technological innovation for this project.

**SWEDFAN**

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