

*Danfoss*

MAKING MODERN LIVING POSSIBLE



# Danfoss Power Electronics

One Company

**focused on  
Climate & Energy**

**Energy Efficiency in Textile Industry**

# Production in Europe, USA and China

## Denmark

Graasten

## Germany

Schleswig

## USA

Loves Park, IL

Milwaukee, WI

## China

Haiyan, Zhejiang Province





**26million**

tons is the annual CO<sub>2</sub> reduction

made by the 2.4 million Danfoss frequency converters installed worldwide

## Solutions Ready: VLT® Drives Electronic motor control



## Danfoss in Textile:



Global SBA organisation for textile

20 years of experience in Textile segment

Develops customized **RELIABLE** solutions for  
Textile to suit Applications

Focus on Higher Energy Savings & Increased  
productivity.

Best after sales & Spares stock support as per  
Textile Industry demand

## Textile industry value chain faces several trends and challenges



**Increase cost of  
Productivity**

**Increasing plant  
Automation-need of skilled  
resources**

**Increasing Cost of labour**

**Increasing Energy Cost**

# How much we can save energy in your plants?

TYPE OF MACHINE	AREA OF IMPROVEMENT	QUANTIFIED IMPROVEMENT
Simplex (main motor)	Production & Quality	10%
Spinning (main motor)	Production & Quality	5%
Spinning (Pneumafil motor)	Energy Saving	25%
Sussen compact spg.(suction fan)	Energy Saving	15%
Auto coner(suction fan)	Energy Saving	20%
Humidification plant	Energy Saving	20%
Compressor	Energy Saving	15%

Process House : **Energy Saving** **15-35%**  
 + Reliable performance  
 + Low cost of ownership

## TEXTILE Mill –Energy Cost an Overview:



Spinning mill capacity :30,000 spindle

Energy contribution

Humidification plant :10,000 units/day

Ring frame :18,000 unit/day

Air compressor :1800 unit/day

**Energy bill/month** : **Rs.45L** (42,000 unit/day)

**Annual Energy Bill** : **Rs.540L**

Spinning mill capacity :83,000 spindle

**Energy contribution**

Humidification plant :17%

**Energy bill/month** :**Rs.250L** (260,000 unit/day)

**Energy bill month for H Plant** : **42.5 L**

**Annual Energy cost of H Plant** : **510L**

**Saving possibility in Humidification plant : Rs.72L/year**

## Energy saving using

✓ VFD

✓ Unique features of VFD

- gives extra saving and low cost of ownership



## Benefits of using VFD's unique features?

1. Saving energy +
2. Reduced down time - Low cost of ownership
3. Better process control - Cost optimization
4. Easy operation/programming - Save labor cost
5. Increased Productivity - Enhance profitability
6. Improved Quality - Reliable performance

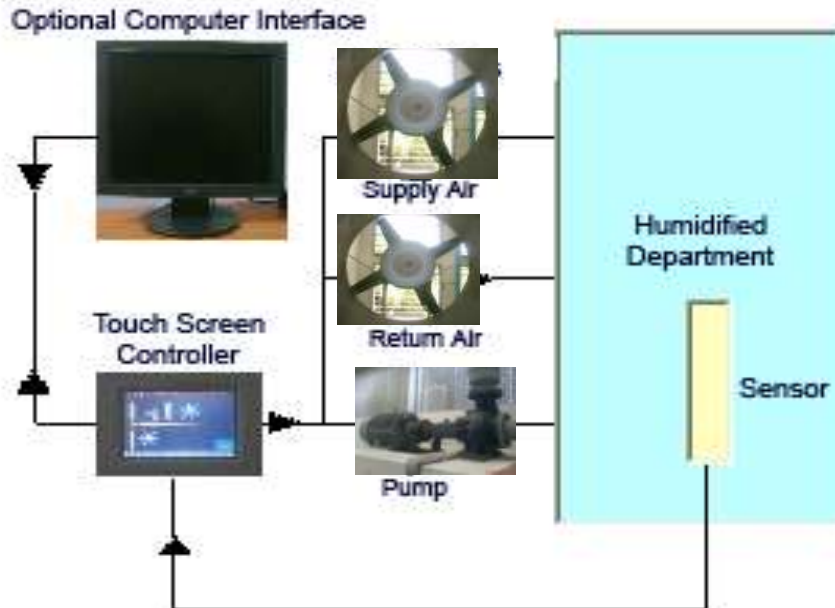
## ENERGY SAVING SOLUTIONS IN HUMIDIFICATION PLANTS

- Energy cost contribution if mfg cost : 10-15%
- H.PLANT Power consumption : 12-15%

**Annual Energy cost of H Plant : 510 lacs** (83K spindle capacity)



## HUMIDIFICATION ENERGY SOLUTIONS



- DESIGN CONSIDERATION FOR HUMIDIFICATION PLANT?
- ARE WE CHANGING THE DESIGN PARAMETERS OF THE HUMIDIFICATION PLANT?
- ACHIEVE ENERGY SAVING WITHOUT COMPROMISING PERFORMANCE

# Dedicated Humidification Energy solution



10 YEARS of Research in Textile Humidification Energy Solutions



**25 - 40% Energy saving !!!**

# VFD AT HUMIDIFICATION

## Study Conducted at Humidification Plant - Preparatory

**CASE STUDY**

Using of Danfoss inverters in Luwa Humidification plants

Customer Name : M/s. Rajapalayam SpinText  
 Location : Rajapalayam, Tamil Nadu  
 Spindleage :

**Saving =  
4.9Lacs/Year**

SI No	Description	Without Inverter Drive	With Inverter Drive	
			Study -I	Study-II
1.	Hours Tested	124	72	92
2.	Units consumed	6517	2819.42	3636.51
3.	Units consumed / Hours	52.556	39.158	39.527
4.	Savings in units / Hour	-	13.398	13.029
5.	Savings in units /Day	-	321.552	312.696
6.	Savings in units / year	-	1,15758.72	112570.56
7.	Savings percentage	-	25.49	24.79

1. Monetary savings obtained per year	= Rs. 4,90,908 /-
2. Payback period	= 11 months

# VFD HUMIDIFICATION

Study Conducted at Humidification Plant -AUTO CONER

CASE STUDY

## Using of Danfoss drives in Luwa Humidification Plant (Auto coner)

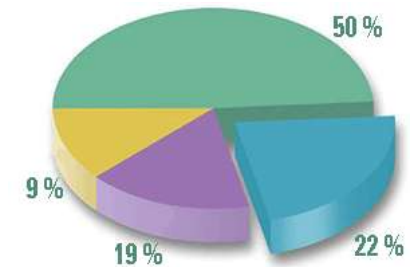
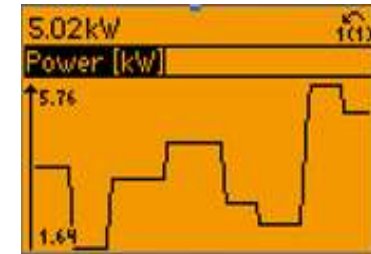
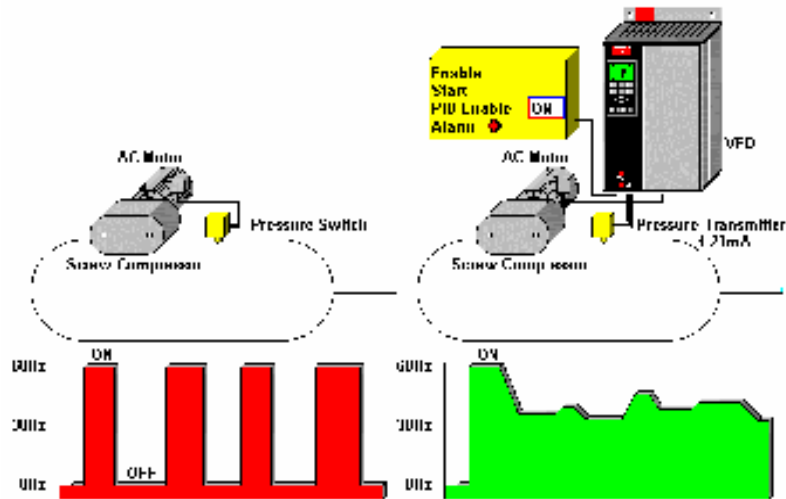
Customer Name : Winsome Yarns Ltd  
 Location : Derabassi, Punjab  
 Spindleage :  
 Date of Study : From 08.05.04 to 13.05.04

**Saving =  
3.1 Lacs / Year**

SI No	Description	Without Inverter Drive	With Inverter Drive
1.	Hours Tested	24	72
2.	Units consumed	1208	2991
3.	Units consumed / Hour	50.33	41.54
4.	Savings in units / Hour	-	8.79
5.	Savings in units /Day	-	210.96
6.	Savings in units / year	-	75945.6
7.	<b>Savings percentage</b>	-	<b>17.5</b>

1. Monetary savings obtained per year	= Rs. 3,18,972 /-
2. Payback period	= 15 Months

# ENERGY SAVING SOLUTIONS IN Air compressors



Energy Saving opportunity

## CASE STUDY

**Recip. compressor : 75kw@ 300cfm \*2 nos.**

- Load/Unload Control : 7bar- 7.75 bar
- Required CFM : 260CFM-400CFM
- Compressor control : 1\* S/D starter, 2nd VFD
- With VLT compressor : 7.25bar- 50%-100% speed

- Energy saving achieved : ~220 units/day
- **Annual Energy saving : ~ 3L**

## Screw Compressor : 160kw

## CASE STUDY

### W/O VFD:

✓ kW-Hrs for 4730Hrs: 614900, Pressure: 4.55 +/- 0.3bar

### With VFD:

✓ Run Hours: 4730 , kW-Hrs: 381900 ,Pressure: 4.55 +/-0.05bar

✓ Energy Saved: 233,000kW-Hrs (37.9%)

✓ Energy saving: Rs.9,32,000/- in 4730Hrs

✓ **Annual Energy Saving(7100Hrs): Rs.13.9L**

✓ Payback/ROI : < 6 months

# VFD for compressor

## CASE STUDY

**TEXSERVICES**  
 149, Trichi road  
 Chinthamanipudur  
 Coimbatore – 641 103  
 India

Date: 27:08:07  
 Place: Aruppukottai

### COMMISINING REPORT

Customer name: M/s SHRI RAMALINGA MILLS LTD. UNIT: B  
 ARUPPUKOTTAI

**Nature of work:**

To commission the danfoss make inverter and pressure sensor with 90 KW compressor.

**Action taken:**

Commissioning of the above Danfoss makes inverter and pressure sensor with 90 KW compressor was completed success fully and it was observed for two days.

**Energy study:**

PERTICULARS	RUN TIME IN HOURS	TOTAL KWH	KWH PER ONE HOUR
WITH INVERTER	24 HOURS	1190.1 UNITS	49.59 UNITS
WITHOUT INVERTER	24 HOURS	1784.4 UNITS	74.35 UNITS

POWER SAVINGS PER HOUR : 24.76 UNITS/ HOUR  
 POWER SAVINGS PER DAY : 594.24 UNITS (AVERAGE)

**Customer's remarks:**

**Service engineer:**

R. Sathesh Kumar  
 27/08/07  
 Service Engineer.

**customer:**

P. Jeyaraj  
 Mr. Thiagaraja  
 Electrical Incharge  
 Unit "B"

SRM 'B' UNIT

# ENERGY SAVING SOLUTIONS IN SPINNING



**ENHANCE Productivity in Spinning-5%**

## ENERGY SAVING SOLUTIONS IN SPINNING-Pneumafil Fan Motor



### Advantages

1. Energy saving up to 20 – 50 %
2. Better power factor
3. Count based suction pressure programming
4. Viewing of suction pressure
5. Monitoring of energy consumption

# CASE STUDY



Using of Danfoss inverters drive in LR 6/s Ring frame-pneumafil fan motor

Customer Name : M/s Subburaj Textiles [100% EOU]  
 Location : Tirunelveli, Tamil nadu  
 Spindleage : 22,176 Count 40<sup>s</sup> (Cotton)  
 Spl Speed : 18,300 RPM

Sl No	Description	Without Inverter Drive	With Inverter Drive
1.	Pressure maintained (M.bar)	650	400
2.	Hours Tested	9.6	9.9
3.	Units consumed	39.36	17.79
4.	Units consumed / Hours	4.1	1.79
5.	Savings in units / Hour	-	2.31
6.	Savings in units /Day	-	55.44
7.	Savings in units / year	-	19,958.4
8.	Savings percentage	-	56.34

**Saving = 56%**

1. Monetary savings obtained per year	= Rs. 83,825/-
2. Payback period	= 6 months

# CASE STUDY

**TEXSERVICES**  
 149, Trichi road,  
 Chinthamanipudur,  
 Colmbatore - 641 103,  
 India.

Date: 22:09:07  
 Place: Kolhapur

## STUDY REPORT

**Customer name: M/s EUROTEx INDUSTRIES AND EXPORTS LTD**  
**UNIT: E-1**  
**E-23, MLD.C, gokual shirgaon**  
**DIST: kolhapure - 416234.**

### Nature of work:

To commission the danfoss make inverter with LR6/S ring frame pnumafil fan.

### Action taken:

Commissioning of the above danfoss make inverter with LR6/S ring frame pnumafil fan motor was completed success fully and its performance was observed for two days.

### Power study and suction details:

#### With out inverter:

<b>Total run time:</b>	<b>Total KWH</b>	<b>Avg KWH per hour:</b>
20.57 hours	88.77 units	4.32 units/hour

#### With out inverter:

<b>Suction level at fan end:</b>	<b>Suction level at mid end:</b>	<b>Suction level at gear end:</b>
11.9	7.9	6.6

#### With inverter:

<b>Total run time:</b>	<b>Total KWH</b>	<b>Avg KWH per hour:</b>
35.63 hours	107.55 units	3.02 units/hour

#### With inverter:

<b>Suction level at fan end:</b>	<b>Suction level at mid end:</b>	<b>Suction level at gear end:</b>
9.4	6.4	5.5

<b>Power saved in units/hour:</b>	<b>Power saved in percentage:</b>
1.30 units/hour	30% of average

**Customer's remarks:** Under Observation

**Saving = 30%**

### Service engineer:

R. Sreedhar  
 R. Sreedhar Kumar

### customer:

C. S. Kulkarni  
 Manager - electrical.

**CASE STUDY**



**M/s. PRIMA PRODUCTS (P) LTD, PACHAPALLAYAM, COIMBATORE**

**Danfoss VFD Trial In Ring frame pneumafil motor**

**Energy Study Report**

**Saving = 44%**

<b>Particulars</b>	<b>Without VFD</b>	<b>With VFD</b>
<b>RF Mc.No. (LR6/s)</b>	<b>2</b>	<b>2</b>
<b>Count</b>	<b>92's</b>	<b>92's</b>
<b>Fan motor capacity</b>	<b>5kw</b>	<b>5kw</b>
<b>Pressure in Water column (Cm) Spindle 600, 300, 1</b>	<b>11.4, 6, 5</b>	<b>7.4, 3.8, 3</b>
<b>Running Time</b>	<b>9:21</b>	<b>7:42</b>
<b>Unit Consumed</b>	<b>39.88</b>	<b>18.77</b>
<b>Unit Consumed/hr</b>	<b>4.33</b>	<b>2.4</b>
<b>Savings/hr in Units</b>		<b>1.93</b>
<b>Savings in %</b>		<b>44.57</b>
<b>Savings/Day in Unitts</b>		<b>46.32</b>
<b>Savings/Year (360Days)</b>		<b>16675.2</b>
<b>Savings in rupees (Rs 4.20/unit)</b>		<b>70,035/-</b>

## ENERGY SAVING SOLUTIONS IN SPINNING- Compact spinning Suction Fan



### Advantages

1. Energy saving up to 20 – 50 %
2. Better power factor
3. Count based suction pressure programming
4. Viewing of suction pressure
5. Monitoring of energy consumption

# CASE STUDY



Using of Danfoss inverters drive on LRG5/1 Elite – Compact converted –Ring frame  
 [Energy study on elite Suction Fan motor)

Customer Name : M/s Rajapalayam mills Ltd  
 Location : Rajapalayam, Tamilnadu  
 Spindleage : Count : 80<sup>s</sup> (Cotton)

**Saving = 41%**

SI No	Description	Without Inverter Drive	With Inverter Drive	
			45Hz	40Hz
1.	Suction pressure [M.bar]	39.5	32.6	26.7
2.	Hours Tested	9.0	9.5	9.0
3.	Units consumed	94.5	76.0	55.8
4.	Units consumed / Hours	10.5	8.0	6.2
5.	Savings in units / Hour	-	2.5	4.3
6.	Savings in units /Day	-	60.0	103.2
7.	Savings in units / year	-	21,600	37,152
8.	Savings percentage	-	23.8	40.95

1. Monetary savings obtained per year	[at 45Hz]	= Rs. 92,880/-
2. Monetary savings obtained per year	[at 40Hz]	= Rs. 1,59,754/-
2. Payback period		=

# Energy saving in Autoconer suction Fan Motor



**ENERGY SAVING UPTO:35 – 50%.**

# CASE STUDY



Using of Danfoss inverters in Autoconer schlafhorst 238

Customer Name : M/s Rajasthan Spg & Wvg mills Ltd  
 Location : Banswara, Rajasthan  
 Spindleage : Count : 2/40 s PV

SI No	Description	Without Inverter Drive	With Inverter Drive
1.	Hours Tested	7	12
2.	Units consumed	77.68	62.79
3.	Units consumed / Hours	11.09	5.23
4.	Savings in units / Hour	-	5.86
5.	Savings in units /Day	-	140.64
6.	Savings in units / year	-	50630.4
7.	Savings percentage	-	52.84

**Saving = 2.1Lacs/Yr**

1. Monetary savings obtained per year	= Rs. 2,17,711/-
2. Payback period	=

# CASE STUDY

Using of Danfoss inverters drive in autoconer –Murata Machoner

Customer Name : M/s Girnar Fibres Ltd  
 Location : Indore, Madhya Pradesh  
 Spindleage :

SI No	Description	Without Inverter Drive	With Inverter Drive
1.	Hours Tested	67.5	67.5
2.	Units consumed (kwh)	1434.0	940
3.	Units consumed / Hours	21.25	13.925
4.	Savings in units / Hour	-	7.325
5.	Savings in units /Day	-	175.80
6.	Savings in units / year	-	63288
7.	Savings percentage	-	34.47

**Saving = 2.7Lacs/Yr**

1. Monetary savings obtained per year	= Rs. 2.72.138/-
2. Payback period	= 7months

## ENERGY SAVING SOLUTIONS IN Simplex



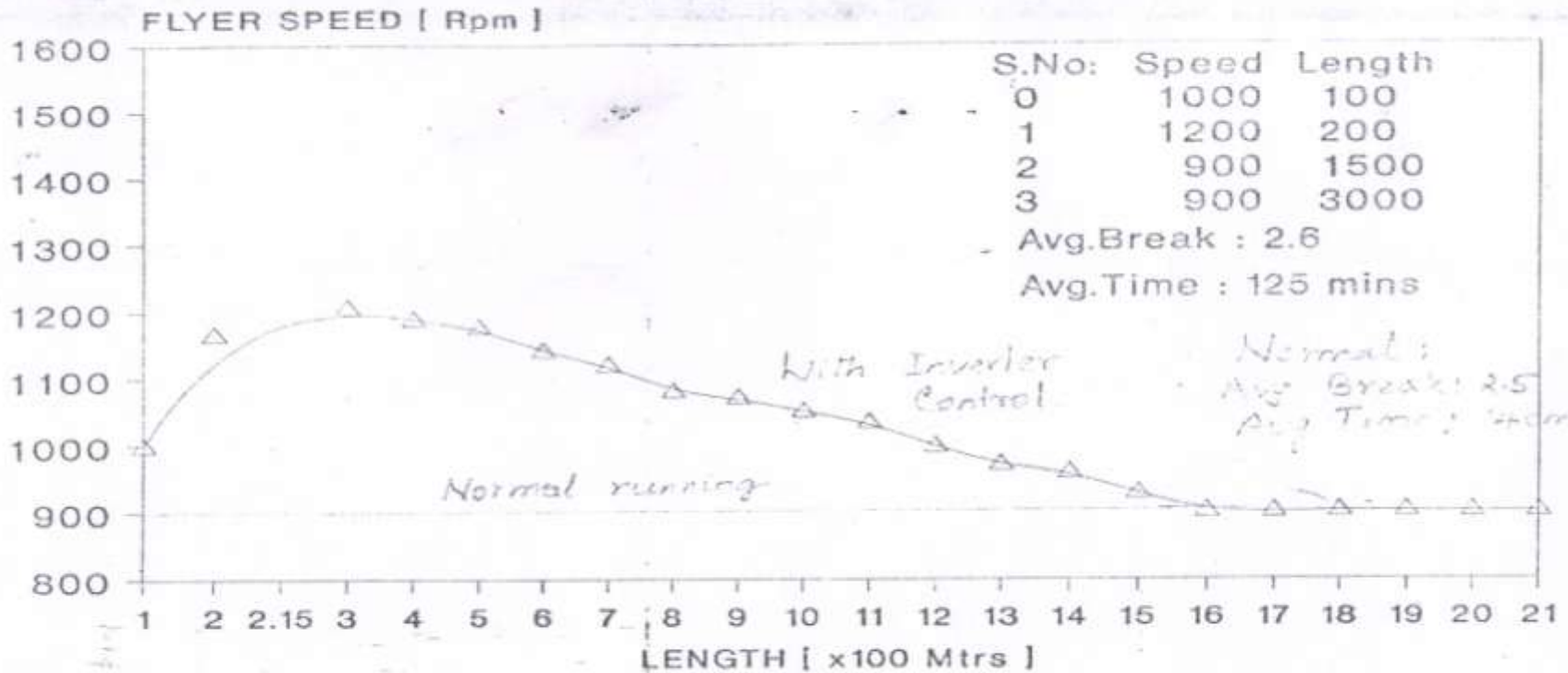
### ADVANTAGES

- Smooth Start/Stop
- Reduction in Roving Break
- **Increased Productivity :4-5%**
- Flyer position control
- Reduction on no.of Inching
- Inrush current avoided and motor heat reduction

# Energy Study Using Inverter on Simplex Main Motor

Handwritten: Mr. R. Maclean

## SPEED CURVE



S.No:	Speed	Length
0	1000	100
1	1200	200
2	900	1500
3	900	3000

Avg. Break : 2.6  
Avg. Time : 125 mins

Normal :  
Avg. Break : 2.5  
Avg. Time : 140 min

—▲— Trial 7

Normal :  
Avg. Break : 2.5  
Avg. time : 140 min

# Energy Study Using Inverter on Simplex Main Motor

**STUDY REPORT**

DATE:17.05.07

Using Danfoss Drive with AMIS Controller For Speed Frame LR-LF 1400 Main Motor

Customer Name: **SREE MANGAYARKARASI MILLS (P) LTD**  
 Location: **MADURAI**  
 Spindlege: **13,440**  
 Count/Hank: **1.10**  
 date Of Study: **From 11.05.07 To 17.05.07**

S.No	Description	Without Drive	With Drive
1	No.Of Spindles	120	120
2	Motor KW	9.3	9.3
3	Avg Run Hours/Doff	2	1.68
4	% Reduction In Doff time	0	16.7
5	Doff Length	2200	2200
6	Average Speed	830	897
7	Bobbin Stretch %	-	-
	a)Initial to Half	0.542	0.441
	b)Initial To Final	0.604	0.527
8	Total Breaks/doff	15	7.66
9	Breaks /100 Spindles Hr	5.98	3.42
10	Reduction in Breakage Rate	0	42.9%
11	Hanks Produced /Shift	10.75	11.2
12	Hanks Produced /Day	32.25	33.6
13	Hanks Increased /Day	0	1.35
14	% Increase in Production	0	4.2

The following Direct Benefits also Highlighted To Customer

- a)Reduction In Starting Current
- b)Increase In Motor life
- c)Flyer Position Control ,Which Reduces Total Breakages
- d)Smooth Variation Of Speeds Which Reduces Total Breakages

For Tex Services

1. 11. 07  
 (H. Arumugam)

FOR SREE MANGAYARKARASI MILLS (P) LTD

*(Signature)*  
 AUTHORIZED SIGNATORY.

( Mr. RAGHUPATHY )  
 FACTORY MANAGER.

**Increased Productivity= 4.2%**

TYPE OF MACHINE	AREA OF IMPROVEMENT	IMPROVEMENT
Simplex (main motor)	Production & Quality	10%
Spinning (main motor)	Production & Quality	5%
Spinning (Pneumafil motor)	Energy Saving	25%
Sussen compact spg.(suction fan)	Energy Saving	15%
Auto coner(suction fan)	Energy Saving	20%
Humidification plant	Energy Saving	20%
Compressor	Energy Saving	15%

## What to look for when using VFDs.

1. 1<sup>st</sup> time investment cost vs total life cost
2. Operating cost of Drive?
3. Reliability /Drive life- 5 or 10 or 15
4. After sales service support- Application knowledge

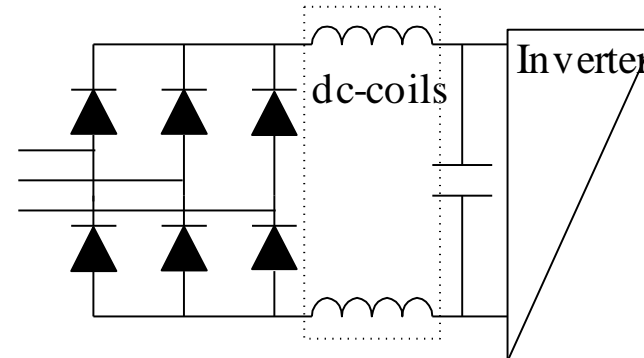
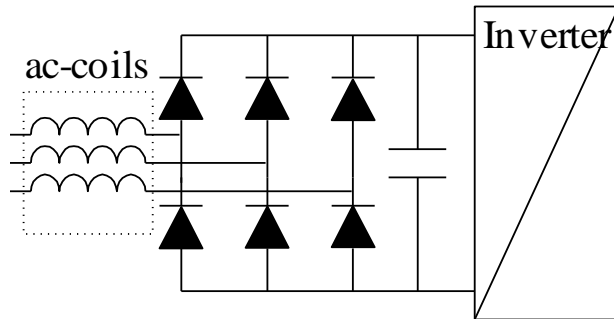


## What is Unique features of Drives help get low cost of ownership?

1. Built in DC Harmonic Filters : reduce the stress on cable-switchgears-Transformers-reduce RMS Amps
2. Highest efficiency of 98% even with DC chokes inside
3. Lowest heat loss of drives
4. Innovative cooling concept- No need of AC or extra cooling
5. High ambient temperature design-50 Deg.C
6. Special coated PPCBs to protect electronics-increase life
7. Motor friendly Technology-No need of Inverter grade motor-Motor life protected- low cost of ownership
8. Automatic Energy Optimizer software to get 5-7% extra saving

# Voltage – harmonic filter solutions

Both DC reactors and AC reactors give similar reduction in harmonics but AC reactor has 3% voltage drop



HARMONIC CURRENT ANALYSIS	
Fund. Current	36.84 A
THD	43.84%
<b>RMS current</b>	<b>40.22 A</b>
5'th Harmonic	14.71 A
7'th Harmonic	5.74 A
11'th Harmonic	2.66 A
13'th Harmonic	1.34 A

HARMONIC CURRENT ANALYSIS	
Fund. Current	36.22 A
THD	42.51%
<b>RMS current</b>	<b>39.47 A</b>
5'th Harmonic	12.91 A
7'th Harmonic	7.03 A
11'th Harmonic	3.06 A
13'th Harmonic	2.10 A

# Heat dissipation

Example: 3 x 400V Drive at the size of 30kW

• <b>Reputed make VFD</b>	Heat Loss	= 1074W
• <b>Make-2</b>	Heat Loss	= 570W

You could save  
Rs.21,000  
per drive per  
Year!!!

**Difference = 504W (46%)**

Working :24 hours x 360days ●  
Energy cost :Rs.5/kWh

**Annual cost of excess Heat loss :Rs.21,772/-** ●

**Plus the extra costs for cooling.....**

## Heat loss difference in 315kw drive cost you 1.15L/year

### VFD make- XX

- Heat loss: 8,650 W
- + 44 % more heat loss or 2,659 W

### VFD make- YY

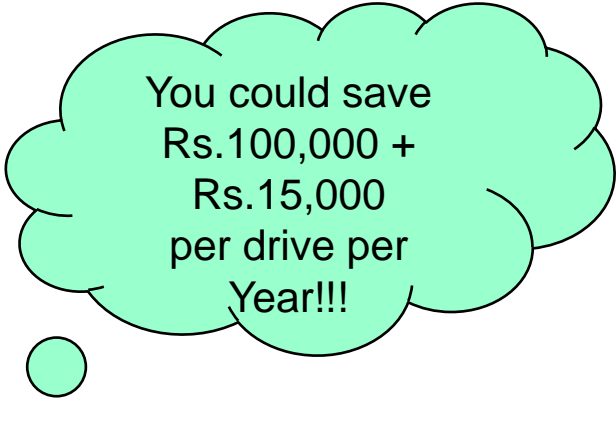
- Heat loss: 5,991 W

### Costs.....

- Energy costs: 1,000 W  $\approx$  Rs.5/-
- Operational hours: 24hrs/365 days
- $\sim$ Rs.100,000 per year

### Additional Costs.....

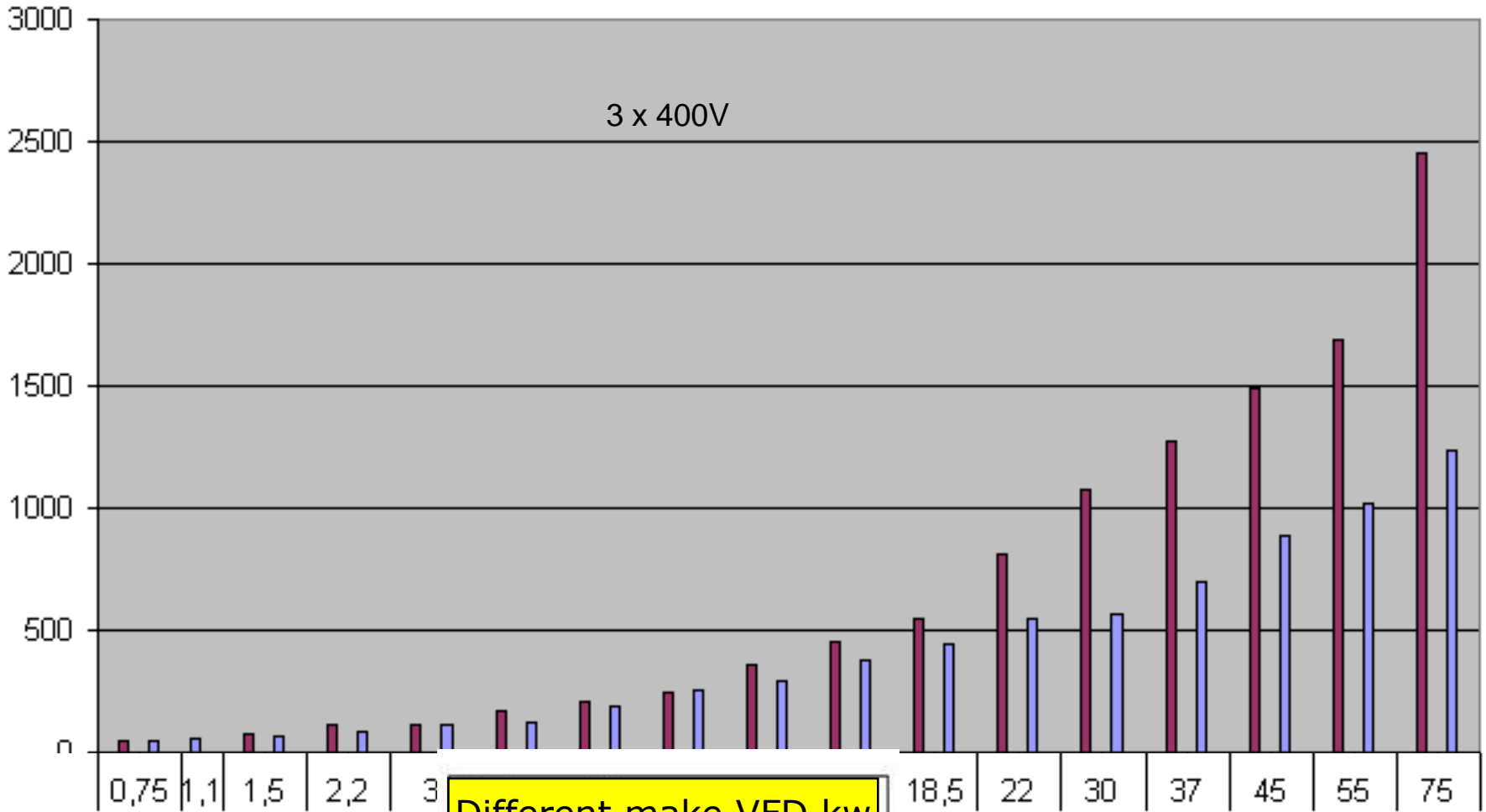
- Air Conditioning requirement for control room.
- Every kW of losses requires another 0.5 kW of energy to remove the heat



You could save  
Rs.100,000 +  
Rs.15,000  
per drive per  
Year!!!

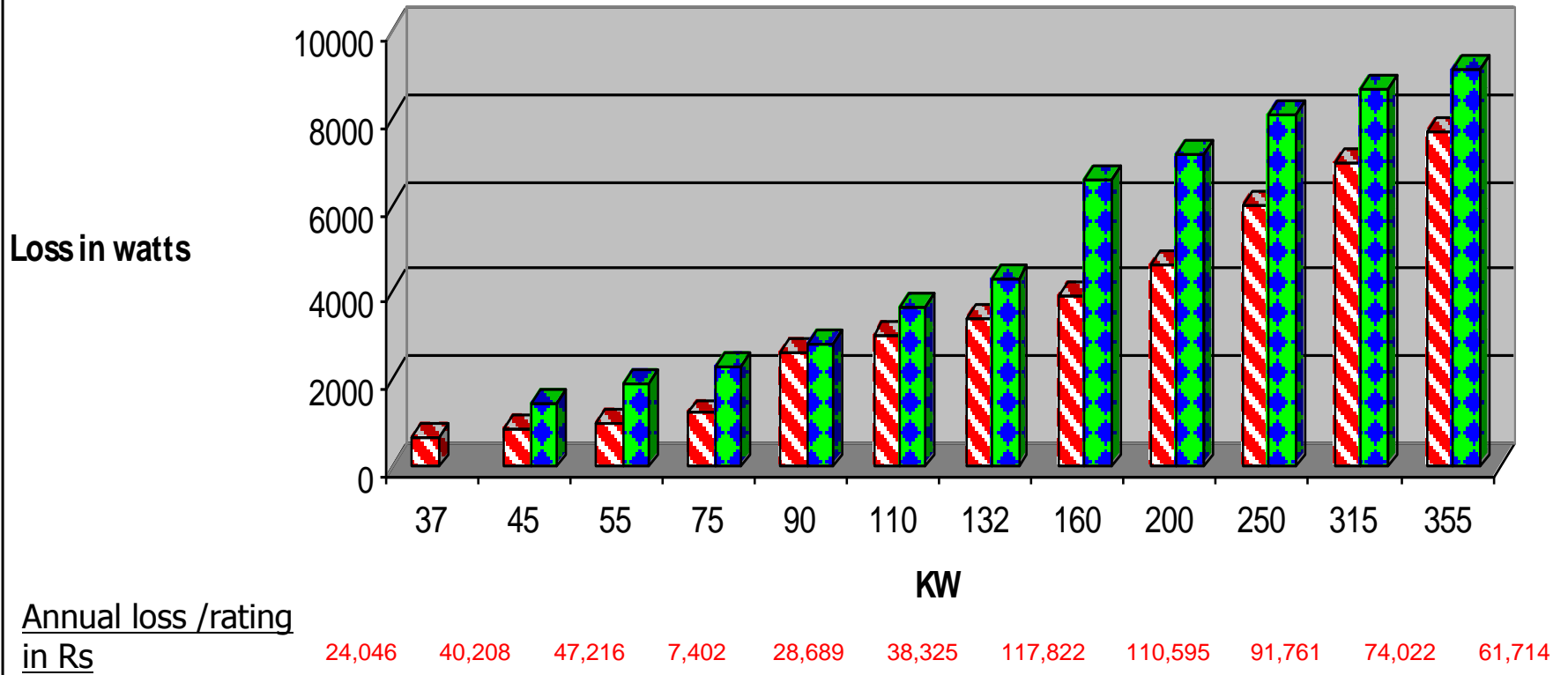
## Heat dissipation- Drain your money indirectly

Heat loss in Watts



Different make VFD kw

### HEAT LOSS COMPARISON



# Aggressive environment affect the Drive life?

**Real life picture.....**

## • Process House Drives

High humidity

High temperature

Corrosion

Failure of PCBs and Drive



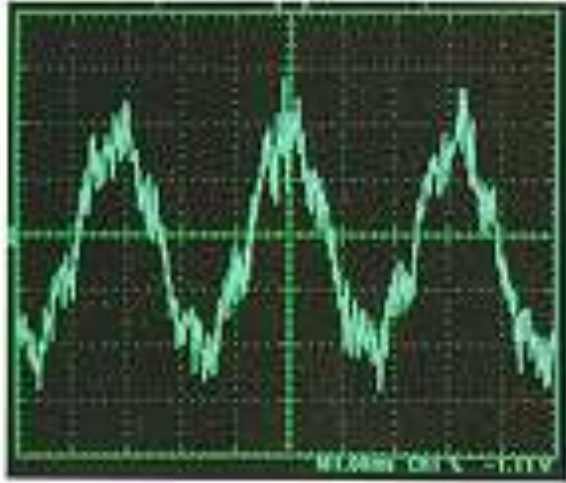


# Process House Drives IP 55 & IP 66 Enclosure

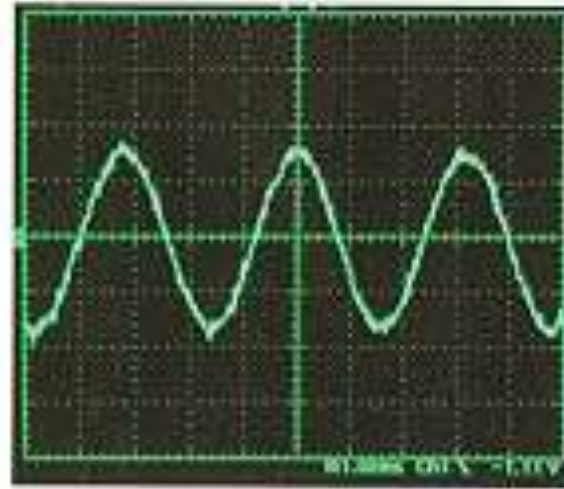
1. Can be mounted on to site where harsh environment like high humidity, temperature
2. No need of AC, Panels –Save cost
3. Can be installed directly at the processing equipment without the need for protective cover.
4. All cast aluminum parts are powder coated with a strong epoxy coating.
5. The corrosion resistance has been successfully tested with detergents commonly used in the industry.



# Technology help Motor life unaffected



**Conventional PWM**



**Danfoss V V C +**

The function of all the parts of the drive, Rectifier, DC Link, Inverter and Control/Regulation is to make a clean waveform to the motor.

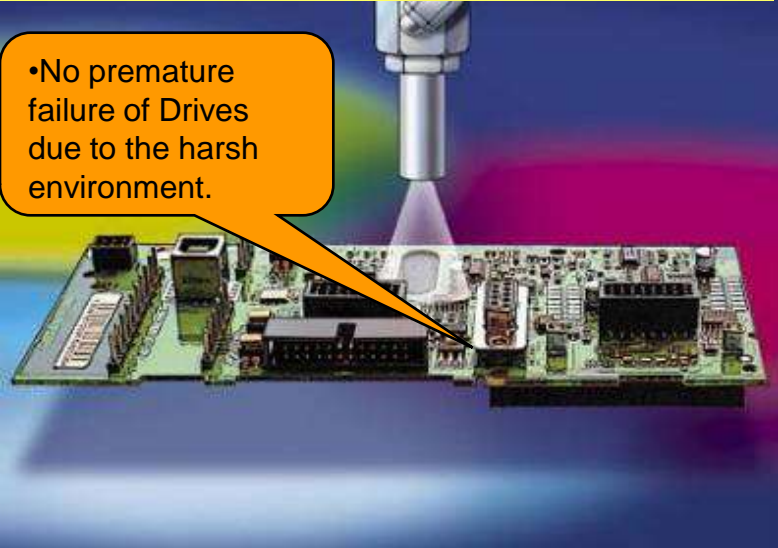


# What is unique feature & advantages?



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## Special coated PCBs as standard



•No premature failure of Drives due to the harsh environment.

Environment Parameter in aggressive environment	Unit	Class				
		3C1	3C2		3C3	
			Mean value	Max value	Mean value	Max value
Sea salt	mg/m <sup>3</sup>	No	Salt mist		Salt mist	
Sulphur dioxide	mg/m <sup>3</sup>	0,1	0,3	1,0	5,0	10
Hydrogen Sulphide	mg/m <sup>3</sup>	0,01	0,1	0,5	3,0	10
Chlorine	mg/m <sup>3</sup>	0,01	0,1	0,3	0,3	1,0
Hydrogen Chloride	mg/m <sup>3</sup>	0,01	0,1	0,5	1,0	5,0
Hydrogen Fluoride	mg/m <sup>3</sup>	0,003	0,01	0,03	0,1	2,0
Ammonia	mg/m <sup>3</sup>	0,3	1,0	3,0	10	35
Ozone	mg/m <sup>3</sup>	0,01	0,05	0,1	0,1	0,3
Nitrogen Oxides	mg/m <sup>3</sup>	0,1	0,5	1,0	3,0	9,0

- To increase the lifetime the PCB's can be conformal coated according to IEC61721-3-3.
- There are several levels of conformal coating described in the IEC norm.
- Most of the drives offered are without any coating and some time it is offered as 3C2 Coating.



- Established in 1999 as 100% subsidiary
- Indian operation focus in
  - Manufacturing,
  - Project Engineering,
  - Marketing,
  - Sales,
  - Training
- 10 sales & service offices across India
- Dedicated sales network focusing on
  - Industry,
  - Textile
  - F&B,
  - HVAC,
  - Water segment

## Solution example: Danfoss Turbocor compressors



# 400,000

Cars removed from the road

is the CO<sub>2</sub> equivalent emission savings of the current installed base of Danfoss Turbocor compressors worldwide

- Danfoss Turbocor is the first high-efficiency, oil-free, variable speed, centrifugal compressor that can provide extremely high energy savings for HVAC systems
- It can reduce up to 35%-50% the energy consumption of a commercial HVAC system
- Today, less than 1% of buildings globally have HVAC systems with high-efficiency, oil-free, variable speed compressors!

# Thank you

**PL.Palanisamy**

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Danfoss VLT Drives.

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