

Scope of Energy Efficiency Improvement and use of Renewable Energy in Dairy Sector

ENGINEERING
TOMORROW

Danfoss

Date: 26th April-2018

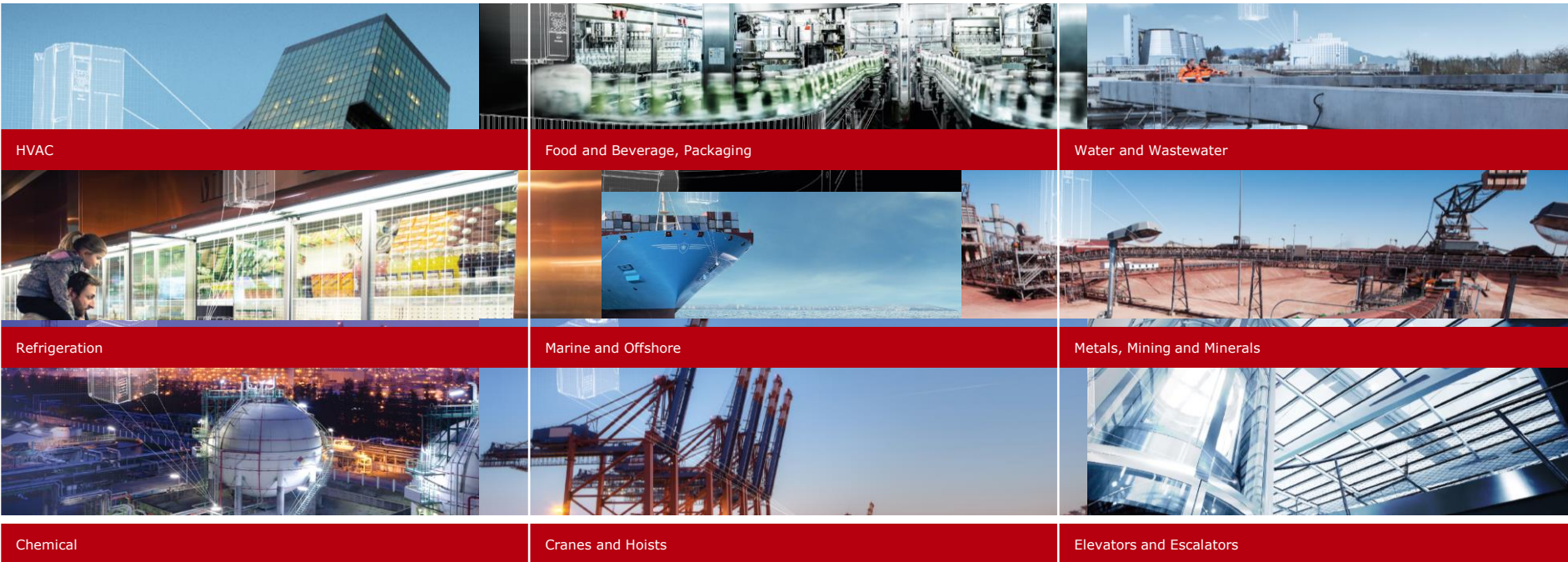
Danfoss Drives :Himanshu Darji



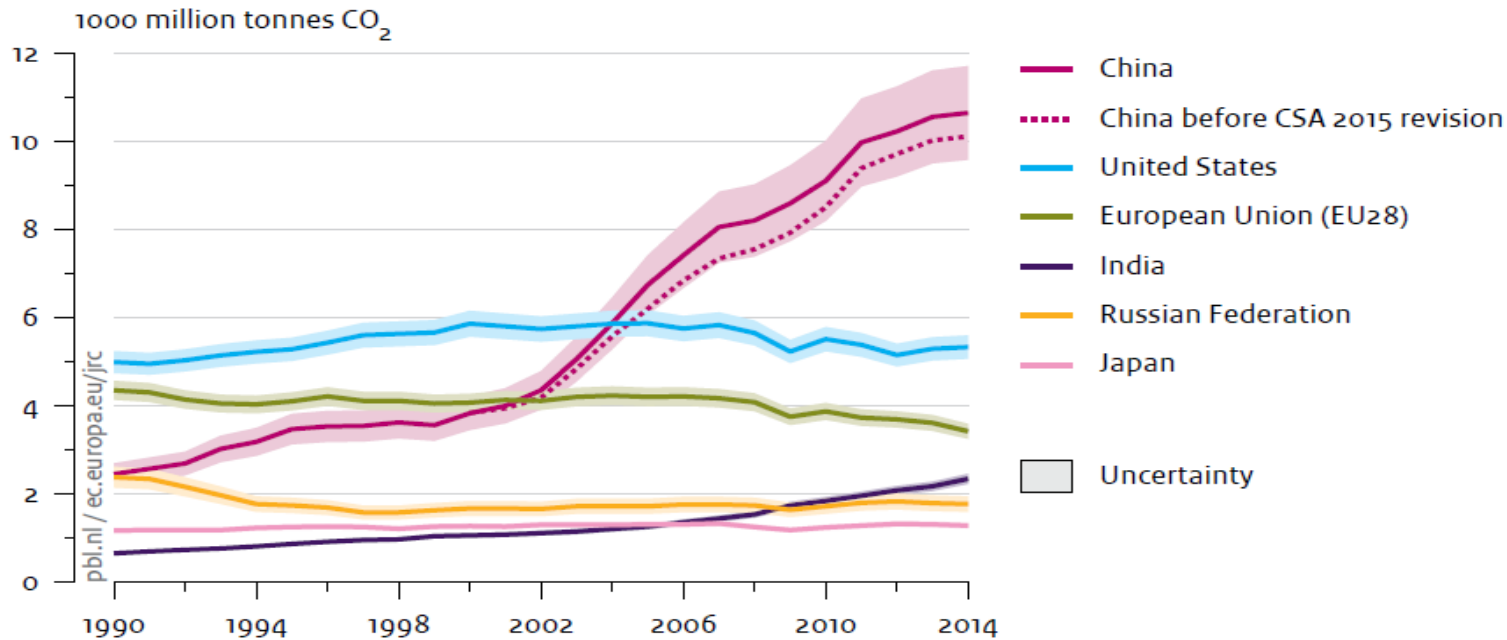
Energy savings Solutions in Dairy

- Introduction to Danfoss
- Dairy applications
- DAIRY Refrigeration compressor
- Cattle Feed Applications
- Hygiene & Efficiency Technology – One GEAR Drive

Providing a competitive edge across industries



CO₂ emissions from fossil-fuel use and cement production in the top 5 emitting countries and the EU



Source: EDGAR 4.3 (JRC/PBL, 2015) (1970-2012; notably IEA 2014 and NBS 2015); EDGAR 4.3FT2014 (2013-2014): BP 2015; GGFR 2015; USGS 2015; WSA 2015

Energy efficiency -Picking the low-hanging fruits

- Global energy demand is predicted to increase by over a third in the period up to 2035.
- **37million tons of CO2 are saved every year** by the 20 million Danfoss VLT® variable speed drives installed worldwide. This corresponds to the CO₂ emissions from more than **19 million cars** in Europe.
- **8 million tons CO₂ could be saved per year** by fully utilizing the potential of pressure independent control valves= CO₂ emissions from > **4 million cars** in Europe/yr.
- Using Automation, we could Save Energy and CO₂ Footprint... & **ROI could be less than 1-1.5 years**
- **70-80%** of new industrial electric motors globally have **not been fitted with variable speed** drives to control their energy use.



Our history

- Founded in 1933 by Mads Clausen in Nordborg, Denmark
- Grown from a solo enterprise into a world-leader
- Made possible by clear focus on innovative engineering and early entry on emerging markets

Cooling

First product was an expansion valve for refrigeration systems (1933)



Later the hermetic compressor for refrigerators and freezers followed (1952)

Heating

Danfoss invented one of the first radiator thermostats in the world (1943)



Power Solutions

Entered hydraulics business with orbit motor for agricultural and construction machines (1964)



Drives

First company to mass-produce variable speed drives for controlling motors (1968)



Today, we are one of the world's leading producers of these and many other products



Danfoss in brief

- 82 years of experience within energy-efficient technologies
- Solutions ready to combat climate challenge
- Global competence center for energy efficiency – rooted in Southern Denmark
- The Bitten and Mads Clausen Foundation holds the majority of shares in Danfoss

Danfoss facts

Employees	24,000
Worldwide sales	more than 120 countries
Factories	61 in 20 countries
Top three markets	USA, China and Germany
Ownership	Privately held
Headquarters	Nordborg, Denmark



Danfoss VLT Production facility across the Globe



Denmark

- Graasten- VLTC Drives

Germany

- Schleswig-Danfoss Power Module

USA

- Loves Park, IL- High Power Drive
- Milwaukee, WI- Customised Panel

China

- Haiyan, Zhejiang Province- Low power Drives <90kw
- Solar Inverter

India

- Mid power Range,
- High Power R&D
- Global Project Engineering Office

Vacon Production facility across the Globe

Vaasa, Finland



Production:

- Mid, High and Mega power range
- Capacity: 300,000 units/year

R&D:

- CX Platform – past platform
- NX Platform – current platform
- M Platform – future Platform

Merano, ITALY

Suzhou, China



Production:

- Low power range production
- Capacity: 150,000 units/year

R&D:

- Micro / Compact Drives
- Supply Chain
- Global Sourcing Center

Production:

- Harsh Duty Platform
- Custom OEM Drives
- Capacity: 50,000 units/year

Pennsylvania, USA



Production:

- Harsh Duty, and NX Mini Factory
- Capacity: 25,000 units/year

R&D:

- Harsh Duty Platform
- Custom OEM Drives
- 575VAC Power Expertise

Our global markets

Share of net sales per region 2017



A world map with red callout boxes indicating the share of net sales for each region in 2017. The regions and their percentages are: North America (24%), Eastern Europe (9%), Western Europe (39%), Latin America (5%), Africa/Middle East (3%), and Asia-Pacific (20%).

North America
24%

Eastern Europe
9%

Western Europe
39%

Latin America
5%

Africa/Middle East
3%

Asia-Pacific
20%

Danfoss Denmark- VLT Drives factory



Newly built Chennai(India) Campus



Introduction –Danfoss Ind Pvt. Ltd.



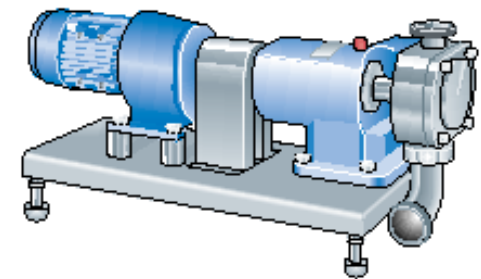
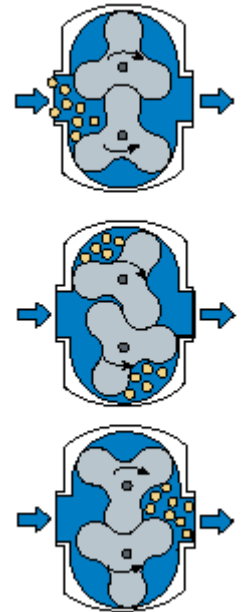
- **100% Subsidiary of Danfoss A/S**
- **Established in 1998**
- **1000 Employees**
- **Corporate Headquarters – Chennai**
- **Turnover > 1000 Crs (2017)**
- **12 Offices & 60 Partner companies**
- **Major Investments on R&D, Manufacturing & Talent**
- **Engineered Panel Solution Facility**



**VFD solutions
In
Dairy Applications**

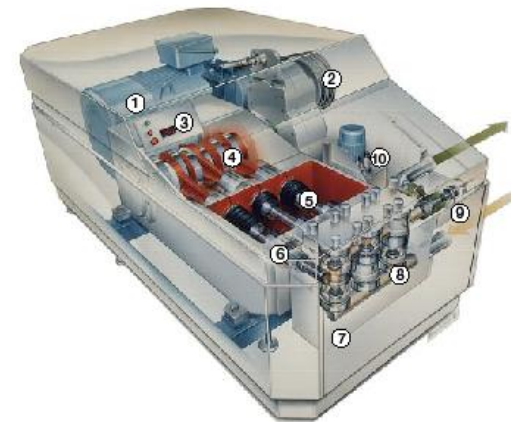
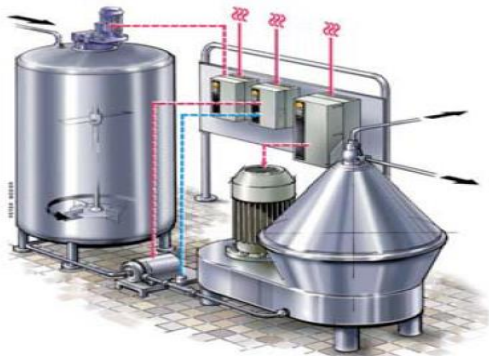
Milk Standardisation -VFD Applications

- **Homogenisers (Control via. Flow or Level)**
- **Separators / Clarifiers (Speed Control)**
- **Silo Agitators (Control via. Level)**
- **Filtration Plants Pumps (Control via. Flow & / or Pressure)**
- **Size range 1.1kW – 50kW**



Butter Manufacturing -VFD Applications

- **Silo Agitators (Control via. Level)**
- **Cream Pumps (Positive pumps) (Control via. Level or Flow)**
- **Separators / Clarifiers (Speed Control)**
- **Butter churns**
- **Size range 1.1kW**



Ice-cream machine -VFD Applications

- **Pin Mixers (Control via. Share-points)**
- **Packing Machines**
- **VFD Size Range 1.1 – 50kW**



Powder plant -VFD Applications

- **Silo Agitators (Control via. Level)**
- **MVR Fans (Control via Temperature Control)**
- **Dryer & Fluid-bed Supply & Exhaust Fans (Control via Air Pressure)**
- **Vacuum Pumps**
- **VSD Size Range 1.1 – 800kW**

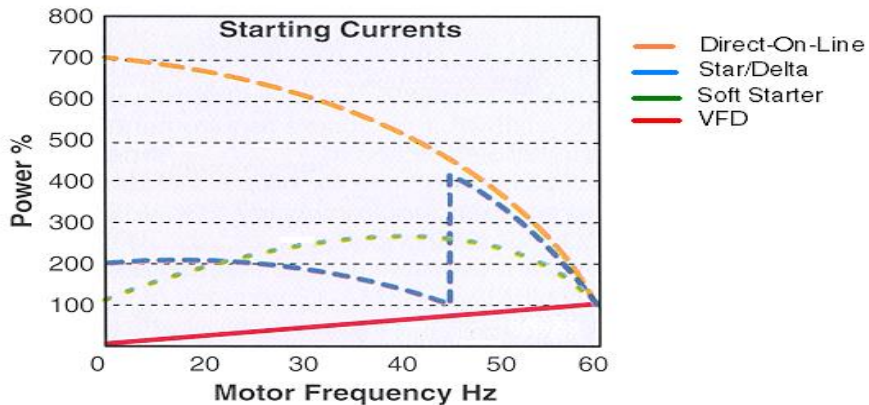


Cheese Manufacturing VFD Applications

- **Transfer *Lobe* Pumps (Control via. Level or Flow)**
- **Cheese Machine Drive Motors**
- **Rapid Cool Storage**
- **VSD Size Range 1.1kW – 90kW**

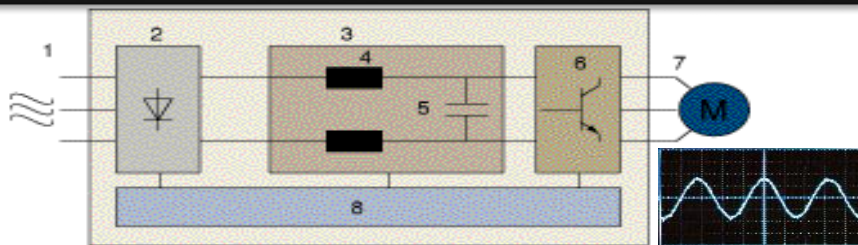


Various Motor starting method and Speed control.



- **Direct-On-Line:** The power required to start the pump can go as high as 700%.
- **Star/Delta:** The Star configuration is used to start the motor. When the motor reaches close to maximum speed, say 45Hz, a relay switches the configuration from a Star to Delta.
- **Soft-Starters:** Control the voltage or the current, many of them can not be used for long periods of time, and usually can not exceed 30 seconds.
- **VFDs:** Control both the frequency & voltage simultaneously. This gives full control & the best method of starting or stopping or speed control.

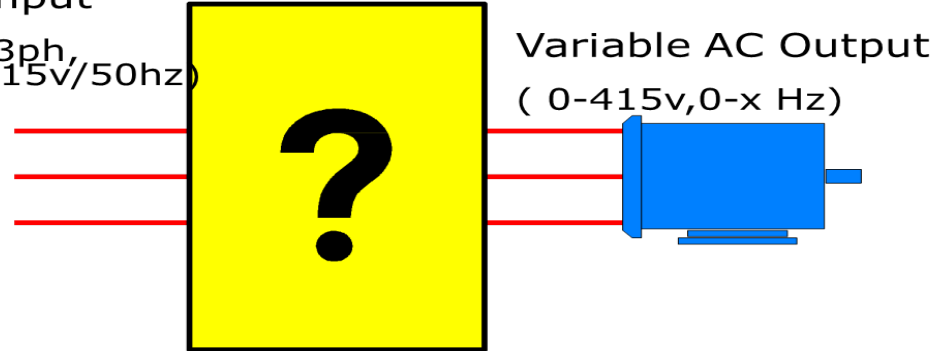
Best motor control option is VFD



What is VFD?



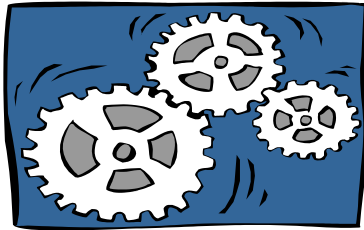
Fixed AC Input
(3ph, 415v/50hz)



- Fixed 3 ph. AC Voltage to Variable AC O/P Voltage controlling AC Motors enabling Speed Change.
- Meet the Application Requirement in Process Control.
- Ability to control standard Induction Motor and Permanent Magnet Motor and standard Servo Motors.
- Energy Saving up to 35-40% based on Application



What VFD can do?



- **Variable speed drives** control the power supply to electric motors so they run at precisely the speed necessary to obtain the desired effect
- Electronic motor control can typically **save 15-40% energy** depending on the application.
- **Improve** productivity of **5-10%**
 - ✓ Reduced down time
 - ✓ Better process
 - ✓ Improved end product Quality
- Potential opportunity for **saving Energy** and **Increasing Productivity**

Physics Laws governing Centrifugal Devices

Basic Centrifugal laws applicable for Centrifugal Fans and Pumps



Flow \propto Speed

Pressure \propto (Speed)²

Energy \propto (Speed)³

20% Reduction in Speed of Pumps / Fans saves 50% Energy

LAWS OF AFFINITY - APPLICABLE ON FANS / PUMPS

If Fan Speed is reduced thru VFD to 80% = 0.8

Then

Air Flow Rate $\propto (0.8) = 80\%$

Pressure Developed by Fan $\propto (0.8 \times 0.8) = 64\%$

Power Consumed by Fan $\propto (0.8 \times 0.8 \times 0.8) = 51\%$

Therefore with 20% Speed Reduction, the Power Consumption is reduced to 50%

Energy Saving in Centrifugal Fan/Blower

Power is proportional to Speed cube

$$P1/P2 = (N1/N2)^3 \text{ where } P=15.0 \text{ KW}$$

$$N1 = 100 \%$$

$$N2 = 75 \%$$

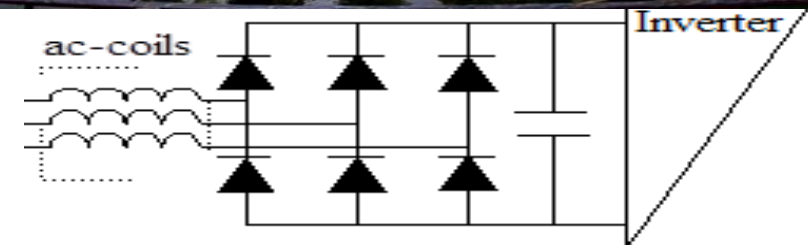
$$15/P2 = (100/75)^3$$

$$\begin{aligned} P2 &= 15/(100/75)^3 \\ &= 15 * (75/100)^3 \\ &= 15 \times 0.75 \times 0.75 \times 0.75 \end{aligned}$$

$$P2 = 6.32 \text{ KW}$$

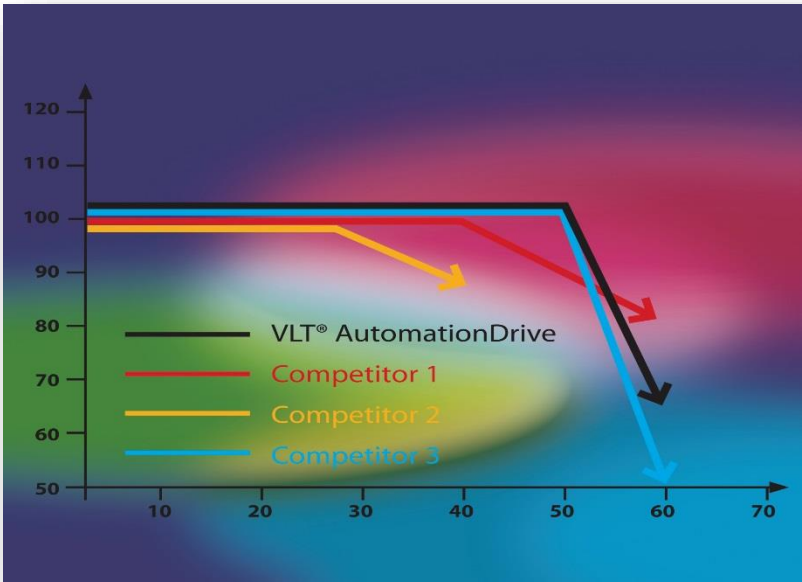
$$\begin{aligned} \Delta P &= P2 - P1 \\ &= 8.67 \text{ KW} \\ &= 8.67 \times 24 = 208 \text{ unit/day} \\ &= 62,400 \text{ unit/year} - \\ &= 4,36,800.00 \text{ Rs/year} \end{aligned}$$

Ability to handle wide Power supply range



- Power fluctuations has an impact on Product life and Performance
- Use of Line chokes in practice
- Voltage Drop in Line chokes have impact in system efficiency
- Drive design to handle wide Input supply of 323V to 550V without external AC Line choke.
- Standard Drive can operate in wide voltage range help improve reliability and Performance.

Designed for High Ambient- 50 Deg.C



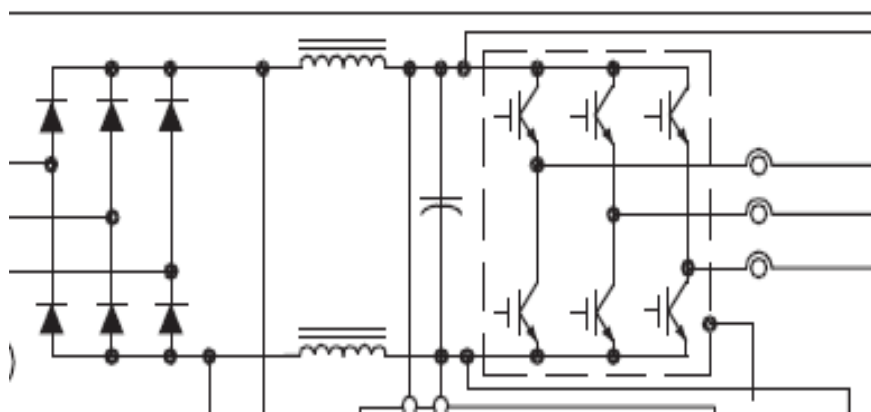
- No need for over size drive
- No Machine down time due to over temperatur tripping.
- Less maintenance cost and increased productive time
- Reliability assured due to high amb. design.

Chokes built in Standard



- Up to 40% lower RMS current compared to VSD without AC/DC coils
- > 0.9 true power factor
- Extra filters / unnecessary over sizing of transformer, cables & switchgear can be avoided in most cases. (+ no voltage drop across line filter)

Built in Harmonic Filters and Wide Supply voltage range

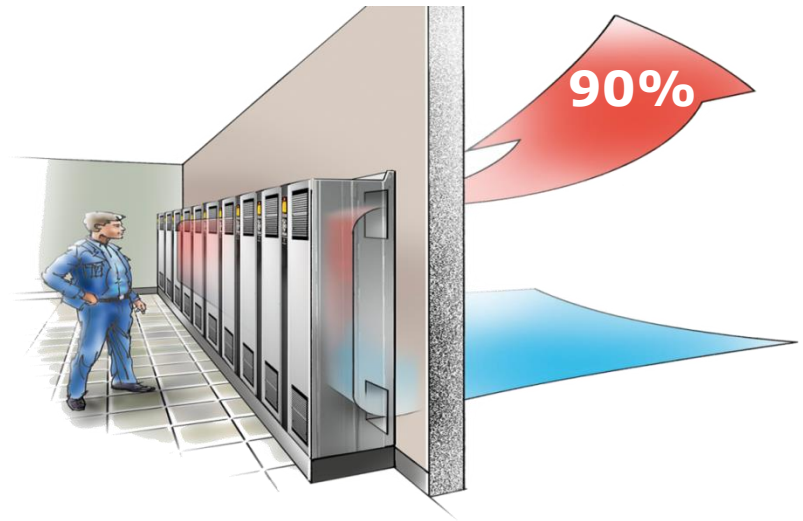


- No interference with other installed equipment
- Built-in DC chokes, no additional installation costs
- Space saving in the panel
- Full output voltage
- Use of External A.C. Choke not required.
- Input THDI -57% reduced
- All Danfoss VLT FC300 drives contain built in D.C. Choke in both the terminal of D.C. bus
- Hence very low harmonics at the input side and also increase the life of the DC capacitor.
- Wide Voltage Input Range of 380-10% and 500+10% .

Intelligent heat management part of installed efficiency



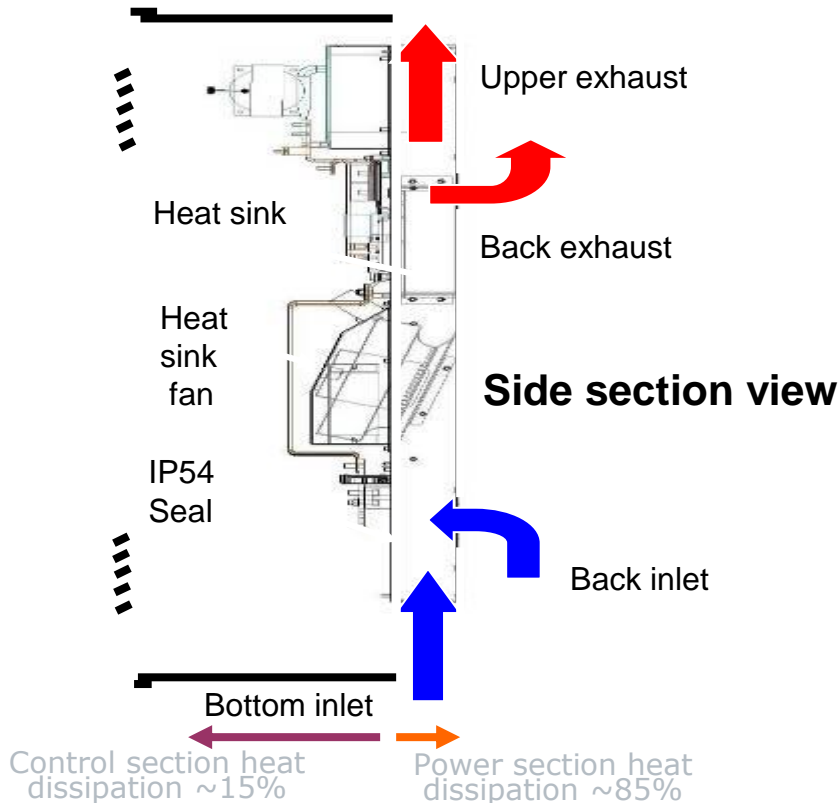
The unique back channel cooling concept transfers up to 90% of heat away from the room. Typically 0.4 W of energy needed to remove 1 W of heat.



The energy saving for a 160 kW drive will be about 15 % of investment made in Danfoss AC drive

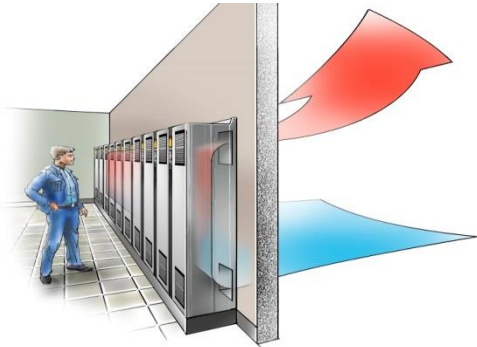
160 kW AC drive standard: Heatloss 3770 W. AC saving $\sim 3770 * 0.9 * 0.4 AC * 0.1 \text{ €} * 0.6 \text{ load} * 24 \text{ h} * 365 \text{ d} = 713 \text{ €} \sim 15 \% \text{ of AC drive purchase price}$

Compact Design & Innovative Heat Management



- Most compact size drives on the market.
- Two cooling air flow paths
- Air ducted in and out the back
- Air ducted in the bottom & out the top
- 85% to 90% of the heat dissipated by the drive is passed via the back channel
- Only 15% of heat dissipated via front door fans (less airborne contamination)
- **Higher Reliability in Harsh Environment**

Innovative Cooling concepts help save Energy

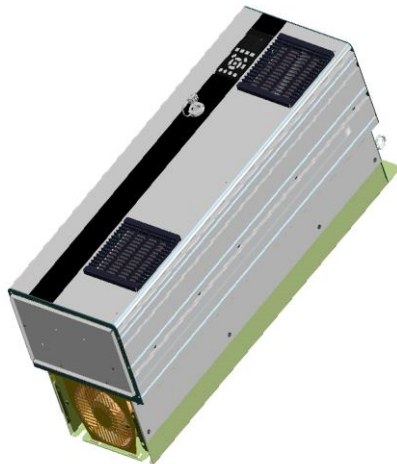


Eg: Control Room with VFD load: 6300kw

Heat loss	: 126kw
Heat taken out of Panel Room	: 107kw
Heat loss in Panel Room	: 19kw

- Innovative cooling concepts
- Push 85% heat outside room
- No need of additional AC
- Only 15% AC Energy required for cooling
- Save AC energy bill: **Rs.1536,000/- yr.**
- Save AC Equipment cost: **Rs.360,000/-**
- Design Available drive operation up to 50 Deg.C w/o need for AC.

Innovative cooling concept +Ease of Service and Maintenance Design



- All serviceable parts can be removed from the front of the drive
- Optional heat sink access panel for easy heat sink cleaning
- Fan life measurement software
 - Displays operating hours of the fan
 - Used for preventative maintenance
- Easy access to heat sink and fan for routine maintenance and cleaning

- Removes up to 90% losses from the drive
- Reduces panel cooling costs
- Reduced control room cooling costs when vented outside
- Control electronics are exposed to fewer contaminants

Product Efficiency focus- Lower Heat Loss



30kw:

• Reputed make VFD-1 Heat Loss = 1074W

• Reputed make VFD-2 Heat Loss = 570W

• Energy saving possibility / yr.: Rs.29,400/-

75kw:

• Reputed make VFD-1 Heat Loss = 1974W

• Reputed make VFD-2 Heat Loss = 1384W

• Energy saving possibility / yr.: Rs.34,692/-

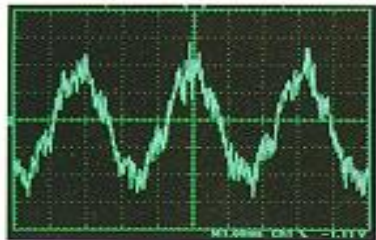
315kw:

• Reputed make VFD-1 Heat Loss = 8650W

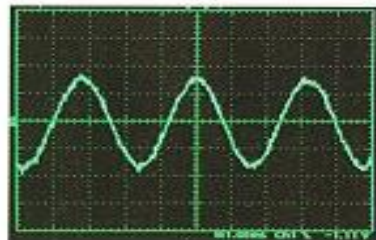
• Reputed make VFD-2 Heat Loss = 5991W

• Energy saving possibility / yr.: Rs.156,349/-

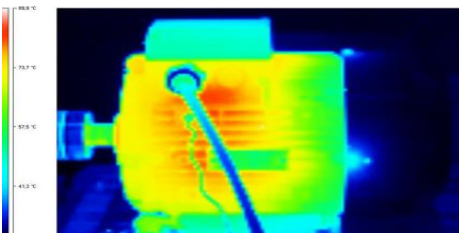
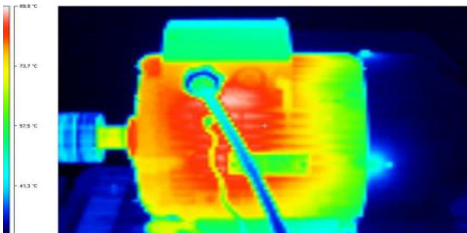
Motor friendly algorithm contributes in LCO



Conventional PWM



Unique Motor friendly algorithm



- Various switching technologies available in Motor Control
- Few patented Technologies can offer VFD output close to fundamental waveform to the motor.
- The more sinusoidal the wave form to the motor the easier it is on the motor
- Less heat produced in motor resulting in longer motor life.

Motor friendly algorithm ensures Enhanced Motor Performance & Lower maintenance cost/ LCO

IP 55 / IP 66 enclosures



- Reliable operation in harsh environments
- No need for cabinets
- Fast and easy wall mounting

Standard Drives for Multi motor control



Types of Motors and trend....

1. Standard Induction Motor
 2. Permanent Magnet (PM motor)
 3. Synchronous reluctance Motor
- Standard VFD can drive all the above motors at 98% efficiency
 - Improved Performance and Operational flexibility with low cost of ownership

Built-in EMC compliance



- The frequency converter is ready to use and faults due to incorrect installation or wrong filter selection are avoided
- Built in RFI filter with selectable performance providing flexibility to meet different installation requirements
- No over sizing of drive necessary – with motor cables of up to 300m
- Immunity from electrical interference and minimal emission
- Saves panel space and installation costs

Innovative features of VFDs – Ensure Low cost of Ownership.



- Award Winning LCP Display
- Graphical 6 line user-friendly keypad
- Inbuilt Operation manual-
- Easy Programming
- Graphical Display for trending
- Customized Display and Parameter Group.

Long Motor Cables



Reliable performance with long motor cables

- Designed for long motor cables as standard
 - 150m screened motor cable
 - 300m unscreened motor cable
- No additional options required for these cable lengths = save costs
- Complies with EMC standards with these cable lengths = reliable system performance
- For longer cables recommend output sine-wave filter

A person wearing a dark pinstriped suit jacket and a light-colored patterned tie is holding a white rectangular sign with both hands. The sign contains the text "Energy Saving solutions In Dairy Plant utilities" in a bold, black, sans-serif font.

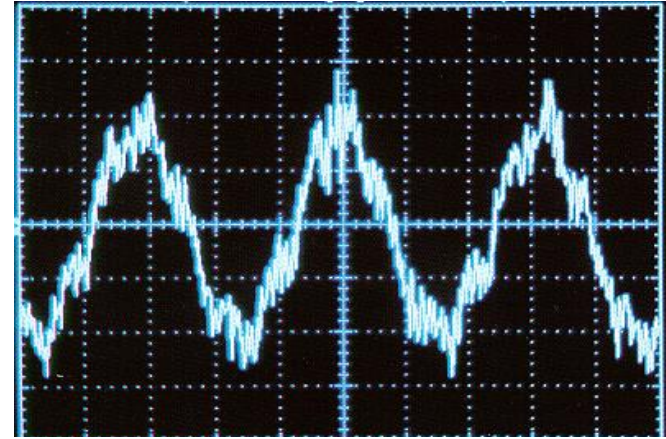
**Energy Saving
solutions
In
Dairy Plant utilities**

Danfoss drives offer Patented VVC+ technology-Motor friendly

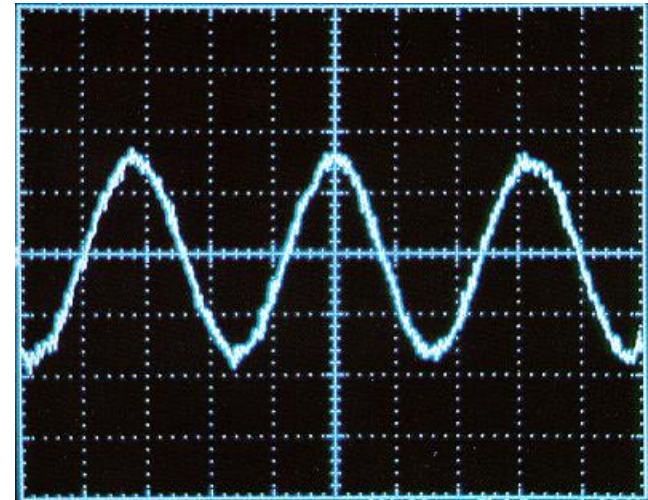
PWM VFD OUTPUT RESULT:

- Motor does not get 100% fundamental voltage
- Stress on motor insulation and winding
- High heat generation
- Need for higher frame or inverter grade motor

Conventional PWM Output

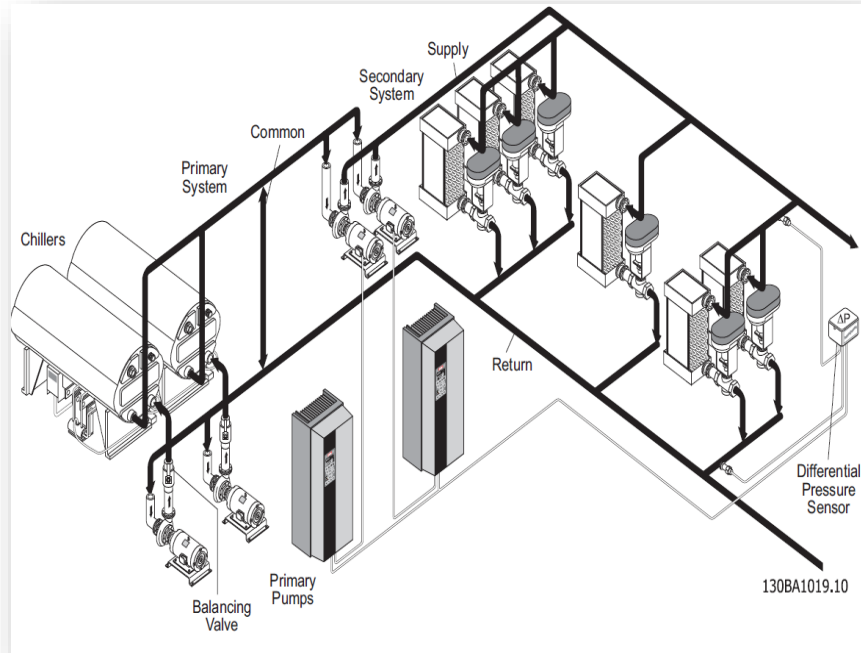


VVC^{PLUS} Output

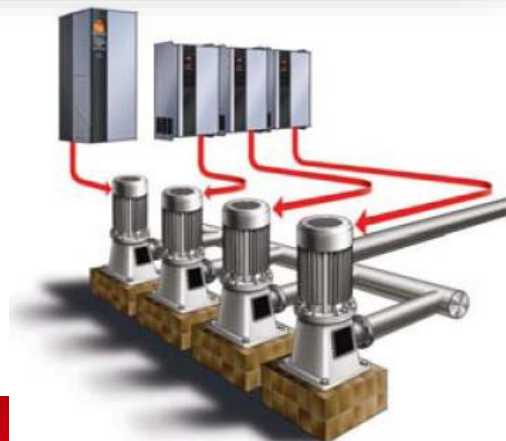


Secondary Chilled Water Systems

25%
savings



- Secondary pumps work as per load requirement .
- VFD's can be used in cascade system to control multiple pumps
- Also in Cascade system one VFD is the master & other slaves
- The VFD helps both in maintaining precise differential pressure set point value & flow.



Energy saving in Refrigeration Compressor

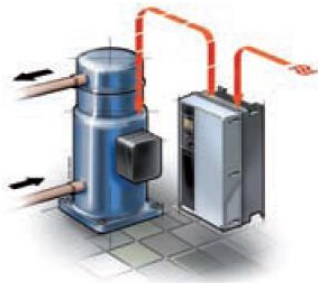


Refrigeration compressor

Refrigeration is 30% - 50%
of the electricity
costs in a Dairy
Industry! →

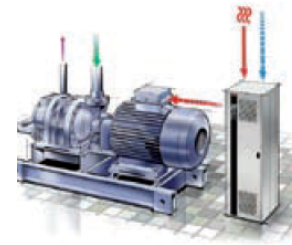
**Can electricity costs be
reduced ? YES!**

Scroll



The scroll and screw compressors are gaining market share in the refrigeration applications. The VLT® drives have dedicated refrigeration system functions to control these compressors.

Screw



Typically divided in oil-free screw compressors and oil lubricated screw compressors. Energy savings from adding a variable speed drive on the oil lubricated compressor will be twice the savings on the oil-free compressor. This is caused by the loss at no-load condition, which is much higher on the oil lubricated type. Further savings are achieved by optimised

Centrifugal

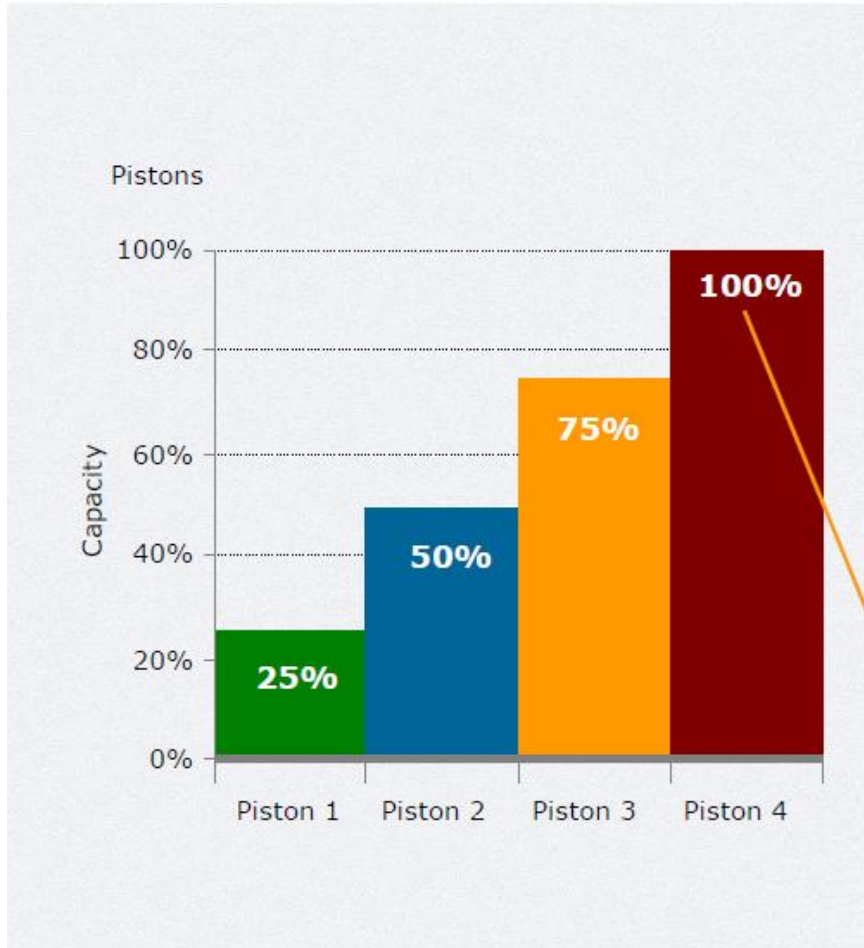


These compressors are used in industrial applications with a large cooling demand. The VLT® drives can control the compressor as well as being integrated in the control system for the plant.

Piston



The piston compressor has the highest market share in refrigeration applications. The VLT® drives can improve performance on piston compressors.



Reciprocating Compressor

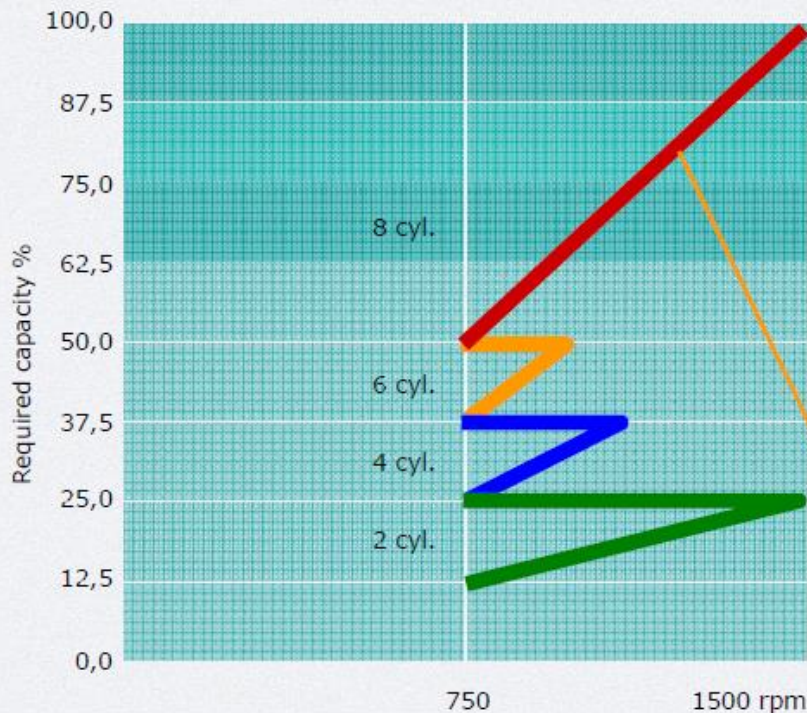
- Solenoid Valve Capacity Control

- Traditional Compressor Capacity Control - Reciprocating.
- Pistons determine Compressor Capacity
- Pistons position are determined by suction pressure PID control
- Slow system control due to 150s dead band
- System delays cause energy losses - lower temperature operation
- No linear capacity control possible (discrete control system)

A capacity of 100% is necessary for a 76% of demand, 24% of Energy Losses

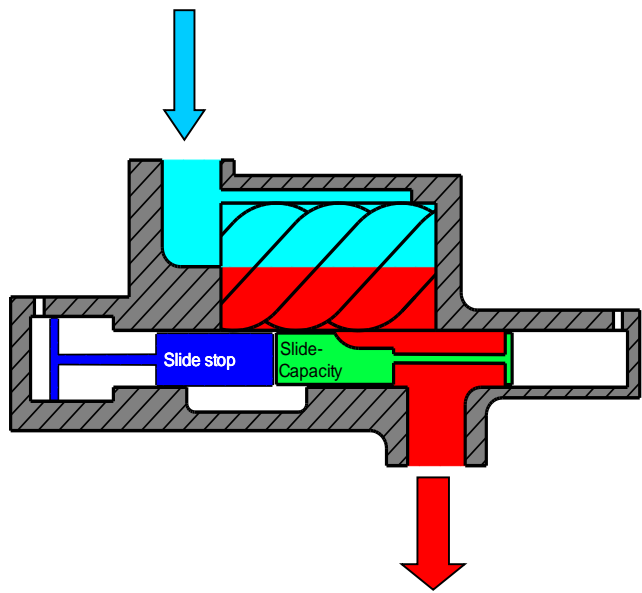
Reciprocating Compressor - VFD Capacity Control

Control strategy example for 8 cylinder compressor

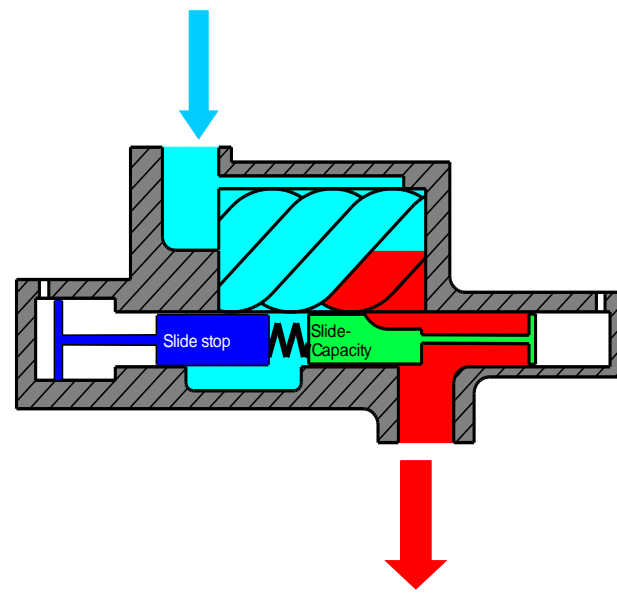


- VFD Compressor Capacity Control - Reciprocating
- Pistons and VFD actuate together for Compressor Capacity
- VFD speed is determined by suction pressure PID control
- There is no dead band (Ramp up/down time is max 30s)
- More linear control possible (unite steps + linear control)
- Minimum speed must be maintained (Motor refrigeration, Oil pressure)

For a demand of 76% a capacity of 76% is required .
No Energy Losses



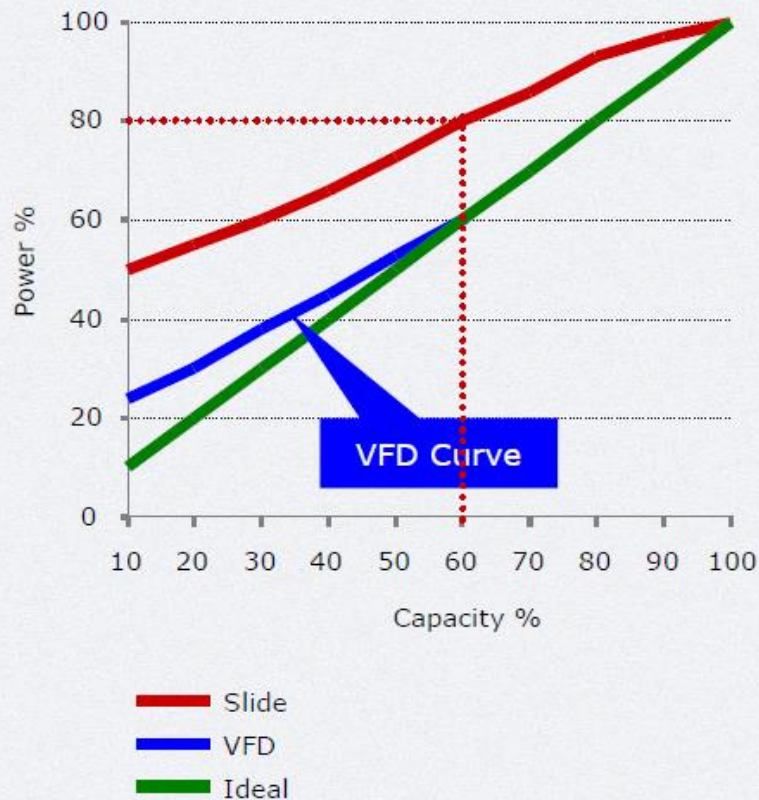
Maximum capacity



Reduced capacity

Active compression part

Slide Valve vs VSD



Screw Compressor

- VDF Capacity Control

- VFD Compressor Capacity Control - Screw
- Slide Valve and VFD actuate together for Compressor Capacity
- VFD speed is determined by suction pressure PID control
- There is no dead band (Ramp up/down time is max 30s)
- Faster system response allows higher temperature operation
- Compressor COP is linear up to 60% of the capacity
- Minimum speed must be maintained (Motor refrigeration, Oil pressure)

No Losses up to 60% of Nominal Speed

VLT[®] Refrigeration Drive Case Story V Dairy





V- DAIRY-

- Education Institute of Dairy Technology est. 1994 & funded By NDDB
- Unique organization in Asia which gives Hand On experience of Dairy Plant for training to students for dairy process technology.
- Installed capacity to process 1 lakh liters of Milk per day. Also manufacturing milk products like Ice cream, Ghee, Paneer and Cheese.

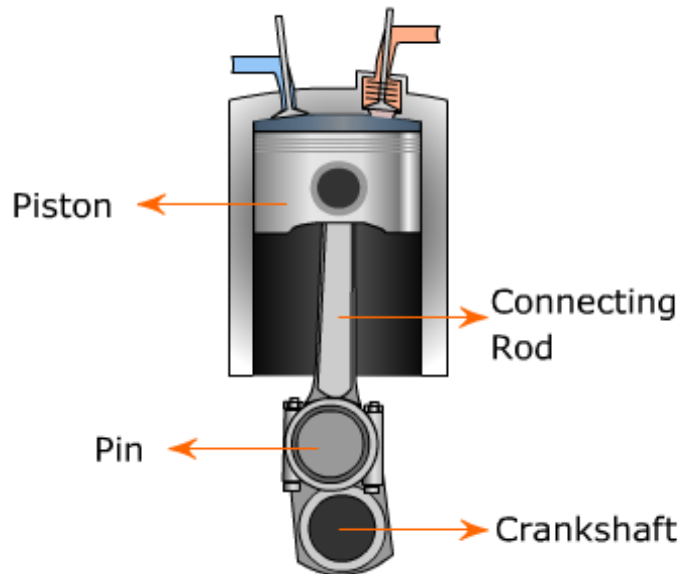


About Application :

- Reciprocating Refrigeration compressor
- Direct-On-Line operation earlier
- Fixed Speed operation
- 03 Pressure switch (Mechanical) for Low pressure (LP), High pressure (HP) and Oil pressure(OP) Trip for Protection of Compressor

Integrated with FC 103 with benefits

- Close loop control with Suction Pressure feedback for optimum cooling and Energy savings.
- Inbuilt Refrigeration Chart in VLT FC 103 drive – enables Suction Pressure feedback conversion to Saturated Suction Temp
- Integration of LP/HP/OP Pressure switches for Compressor trip protection with FC-103
- Integration of Solenoid Valve of Compressor (SV1 & SV2) for Capacity Control . i.e 50%, 75% & 100% with Relay Output of FC-103





Refrigeration Plant:

Kirloskar make Reciprocating (KC3/KC4/KC6)
Refrigeration compressors -5 Qty.

VFD Positioned and Value Proposition:

FC-103 Refrigeration VFD

132kw- 1 no.

90 Kw- 1 no.

37KW –03 Nos.

- IP-55/ IP 54 Enclosure
- Mains Disconnect switch < 90 kw.

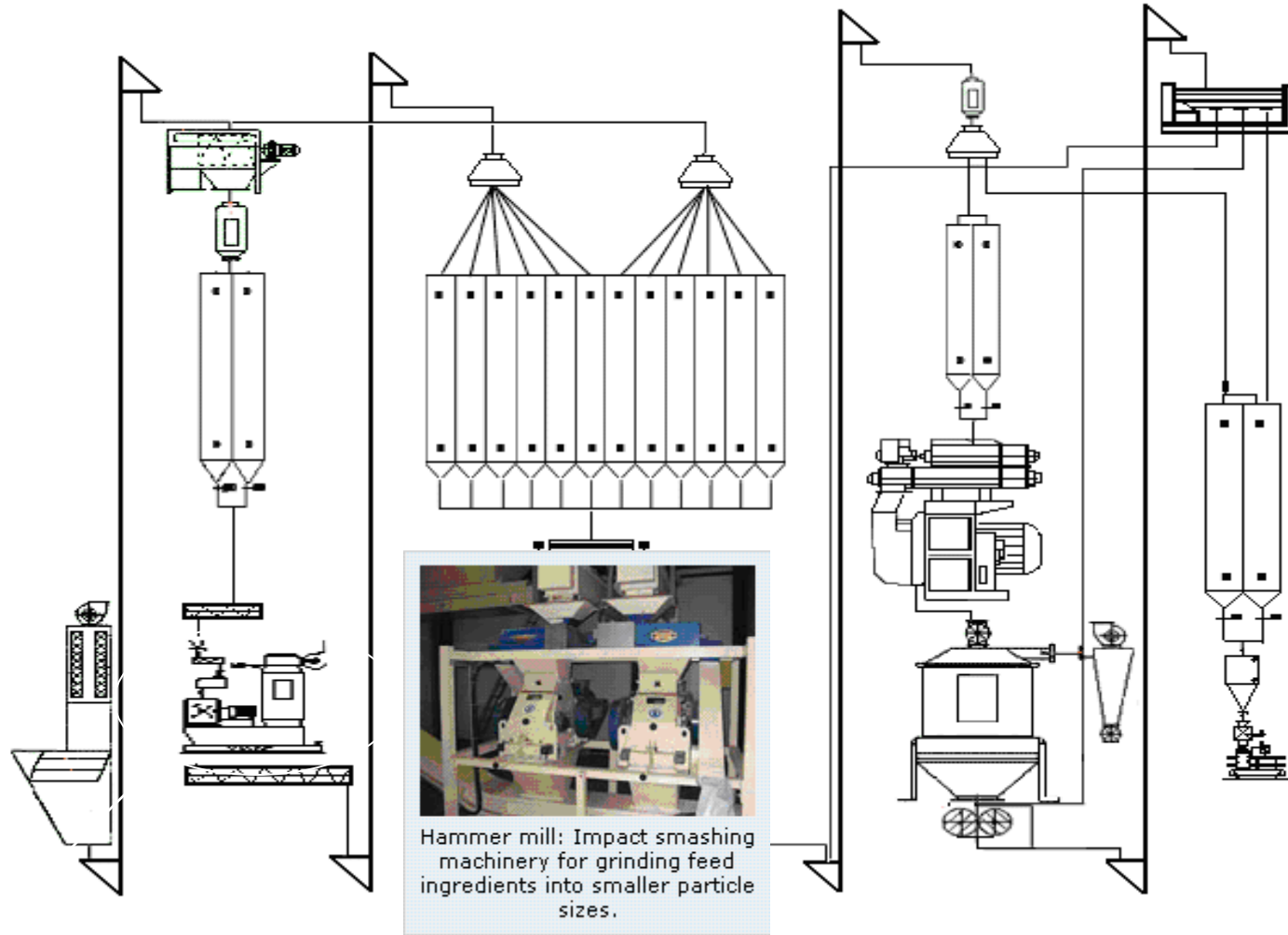
- Motor Rating: 110kw
- Refrigeration Compressor : KC-4 /Reciprocating- 4 Cylinders
- Operating Hours : 18 Hours/ Day (350 Days)
- Electricity Rate : 8 Rs/ Unit
- FC-103 Refrigeration VFD Cost: 132 kw- Rs 350000/-
- Energy saving analysis :

	Without VFD	With VFD
Average Compressor Running Ampere	185	175
Energy Consumption KWH @ 400 Volt	114	108
18 Hours of Daily Operation - KWH/Day	2050	1939
Difference of KWH/Day	111	
Operating Days Annual	350	
Total Energy Saving- INR	310800	
Return On Investment	1.13	Years

A person wearing a dark pinstriped suit jacket and a light-colored patterned tie is holding a white rectangular sign with both hands. The sign contains the text "Energy Saving solutions In cattle feed plants" in a bold, black, sans-serif font.

**Energy Saving
solutions
In
cattle feed plants**

Hammer Mill



HAMMER MILL

22%
savings on
Hammer
mill

■ Mesh Section:

Motor rating : 120 HP (148 Amps, 2975 RPM)

Starting current : 370 Amps

No load current : 30 Amps

■ Danfoss SLC logic controller, controls cycle time for crushing:

No of Batches/ month : 2000

Each batch cycle time : 12 min (1 min idling)

So idling time for which motor is running at no load current:

2000 cycles x 1 min (idling time) x 30 amps (10 kw)

= 2000 kw/ month

Cost of energy wasted = 2000 kw x 6 rs/unit (unit price as per GAVL electricity bill details)

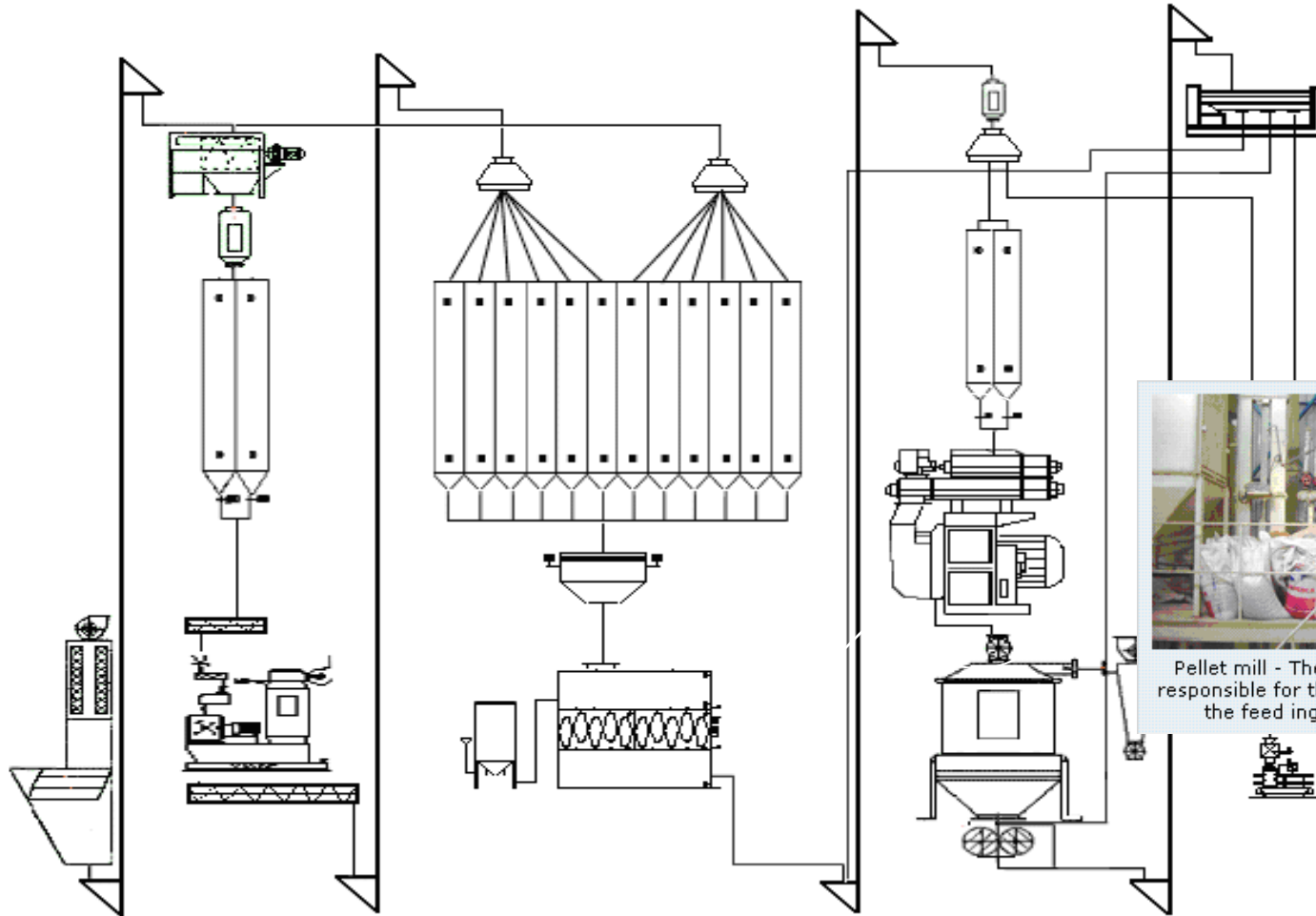
Total savings = 2000 kw x 6 rs/unit = 1,20,000 Rs

Price of IP 20 Danfoss drive FC 302 (120 HP) = 150000 Rs.

$$\text{BEP for drive} = \frac{150000}{12000} = \mathbf{14 \text{ months}}$$



Pellet Mill



PELLET MILL

4%
increase in
production

■ Pellet Mill section:

Motor : 215 HP Motor (260 Amps, 1470 Rated RPM)

Actual RPM after copper losses/ slip : 1400 RPM

■ Drives can run the motor at rated speed or higher speed
Hence with VFD implementation the motor can run at rated speed of 1470 RPM.

Hence in increase in speed = $\frac{1470 - 1400}{1400} = 4\%$ increase

Increase in production = 4%

Per day production w/o drive & VFD = 200 TPD

Total production with VFD & higher speed = $200 \times 1.04 = 208$ TPD

Total increase/per month = $8 \text{ tons/day} \times 30 \text{ days} = 240 \text{ TPD}$

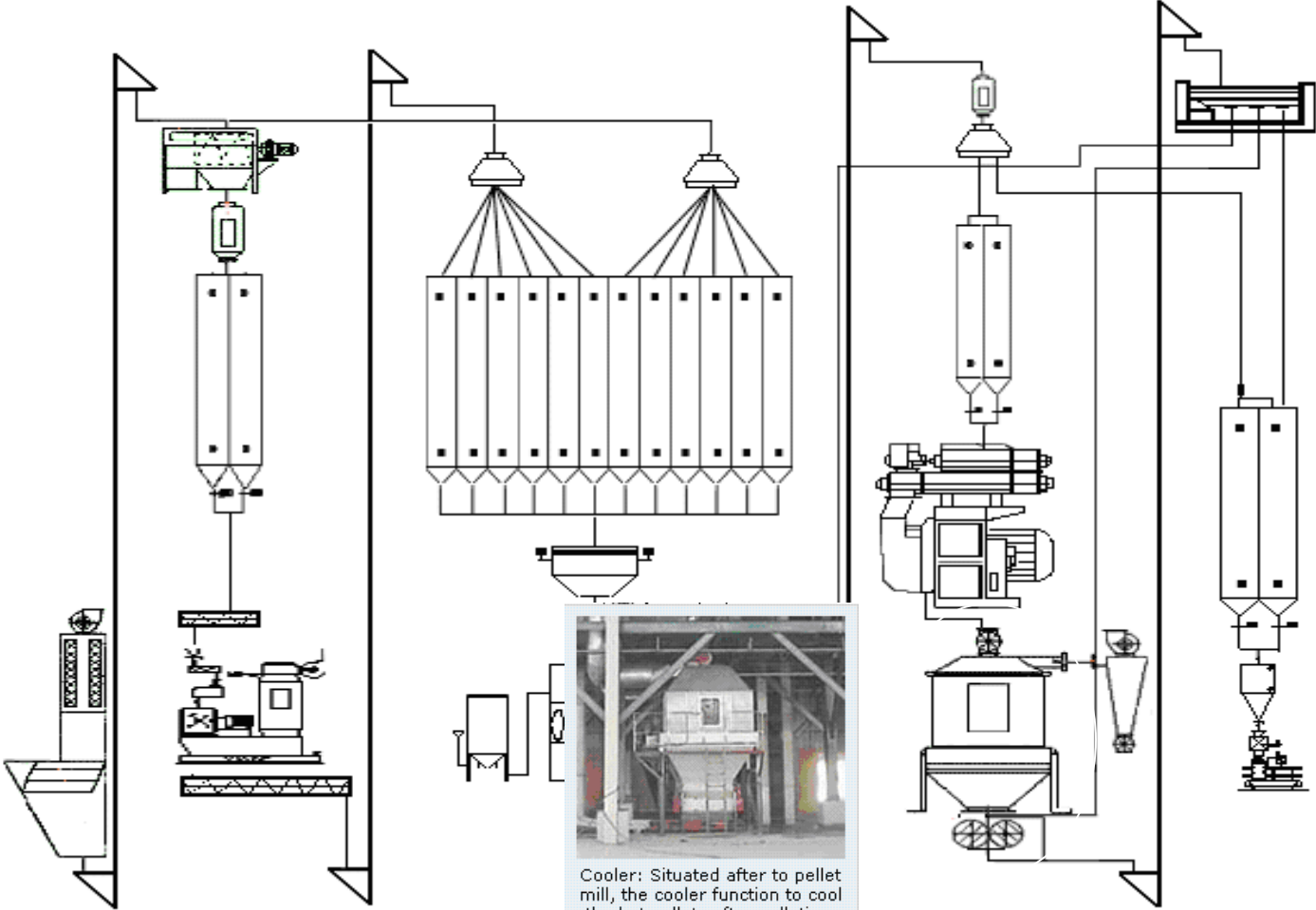
per kg feed cost = 4 rs/kg)

Total increase in sales = $240 \times 1000 \times 4 = 9 \text{ lacs/month}$

BEP = < 1 month



Pellet cooler Blower



Pallet cooler Blower

27% energy savings on Blower

- Pellet Cooler Blower :
Motor : 25 HP (34 Amps)
No load current : 22 Amps
Damper position : 80%

With VFD implementation damper position : 90%

Speed reduction = 10%

speed is proportional to CUBE of current

Hence 10% speed reduction by VFD = 27% savings

Hence savings in current = $0.27 \times 22 \text{ Amps} = 6 \text{ Amps}$ (2.2kw)

Hours of operation /day = 20 hrs

Power consumption/day = 44 Kw/ day

Savings in power cost/day = $44 \times 6 \text{ rs/unit} = 264 \text{ Rs/day}$

For a month = $264 \times 30 = 7920 \text{ Rs}$

Price of VFD FC 301 25 HP : 120000 Rs.

$$\text{BEP} = \frac{120000}{7920} = \mathbf{15 \text{ Months}}$$



OTHER APPLICATIONS

VFD :

- **Paddle type Batch Mixer**
 - **Ripening Bin Agitator**
 - **Spare feeders**
 - **High Pressure Fans**
 - **Premix Batch Mixer**
- Air compressors: Range 10 – 15 HP**
- **ID fan: Range 3 to 50 HP**
 - **FD Fan: Range 3 to 50 HP**
 - **Intake Elevator: Range 10 – 15 HP**





Challenges faced by Dairies

- Hygiene requirements for Food products especially for flavoured milk, ice cream and cheese sections for wash down applications.
- Inaccessible wet areas, geared motors cannot be cleaned which results in deposition of milk and sugar elements.
- Hygiene standards like FDA may implemented which would require to upgrade motor hygiene standards
- Motor + gearbox + VFD efficiency as low as 58% which results in loss of energy and increased power consumption.



For each area the right solution



for wet areas

for conveyors after bottle washer, rinser, filler and sealer for clean rooms and Aseptic- filling plants



for wet and dry areas

for bottle, can, tray-, crate- and pallet conveyors



for wet and dry areas

for packaging infeed- and outfeed conveyors, crate conveyors and pallet turning station

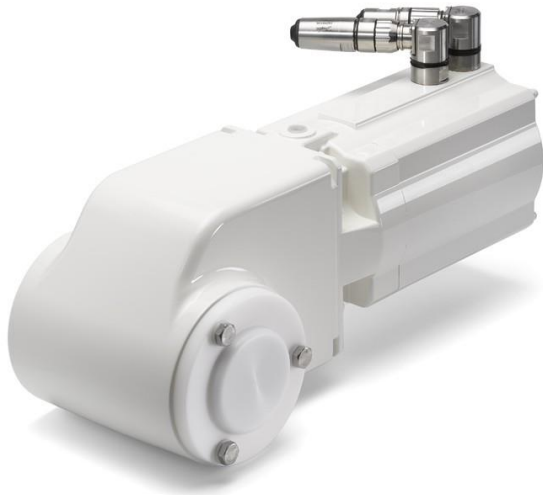
OneGearDrive™ „Hygienic“



OneGearDrive™ „Standard“



Advantages



- Completely smooth housing
- Optimised hygienic and surface design
- No breather necessary
- optional Resolver installation
- Motor- and encoder connection with Danfoss stainless steel connector CleanConnect™
- Efficiency optimised system
- With permanent magnet three-phase synchronous motor

„Clean“ connection technology



- absolute smooth connector housing
- complete from stainless steel
- free of gaps, thereby easy to clean
- foolproof coded, therefore highest connection reliability
- resistant against cleaning- and disinfection solutions
- easy handling, connectable without tools
- Gold-coated contacts ensure safe current transmission in wet environments

Aseptic lacquer



Structure- free surface with extremely smooth roughness $Ra \leq 0,8 \mu m$

- Protected against mechanical adhesion
- Nonpolare lacquer surface
- Paint finish (Aseptic lacquer) resistant to all commonly used cleaning solutions and disinfectants within the range of pH 2-14
- Surface coating with in FDA conform execution

Process adapted material selection

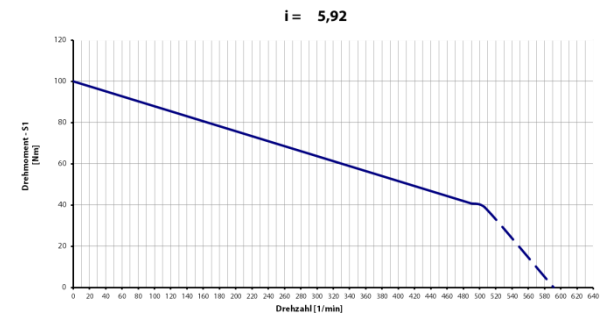
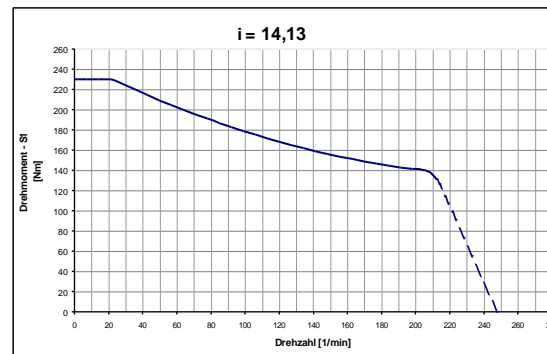
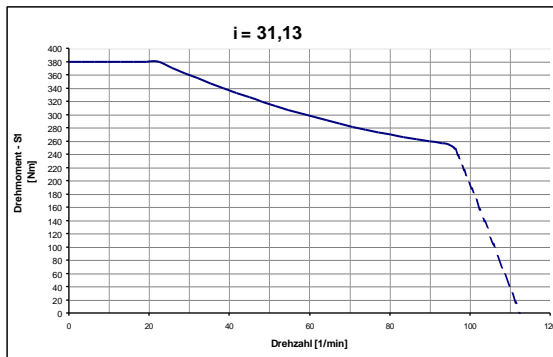


Stainless steel hollow shaft (AISI 316ti) with available diameters: 30, 35 or 40 mm

- Shaft seal from Viton
- High protection, class IP 67 and IP69K
- Lubrication with FDA and NSF listed oil and grease (food grade)
- Oil change at the earliest after 35.000 working hours in partial-load operation necessary

VLT OneGearDrive™

- 10- pole motor for constant duty S1
- Power max. 3 KW; Voltage 400 V; max. Speed 3000 1/min
- Thermal motor protection (KTY Thermistor)
- Motor control through Danfoss Frequency Converter FC/ FCD 302
- Output frequency 0- 250 Hz



Applications: Conveyors



VLT OneGearDrive reduce energy costs



Customer Benefit

- PSM better than super premium efficiency class IE 4
- Energy consumption only in direct dependence on the torque requirement
- High efficient 2 stage bevel gear

Customer Value

- Overall efficiency of about 86 - 89%
- Optimized case temperature at the surface
- Constant efficiency over wide load and speed range

Typical Line of 1 Drives = Total 1.5 KW
NBA means worm gear motor (IE 1)
Typical operating hours = 8760 hrs/ year (365 Days)
Average electricity cost = 8.00 Rs. / KWh
Total yearly run costs = Rs.
NBA Efficiency = 55 %
OGD Efficiency = 89 %
Efficiency dividend = 34%
Efficiency Dividend = Rs. 36792 year

Customer Value Rs.

Rs. 36792 / Geared Motor

Value Quantification

Consultant / Key Customers/ OEM

Amul Kaira

Banaskanta Dairy

Sabar Dairy

Mother Dairy
Gandhinagar

Mehsana Dairy

Dudhmansagar Dairy

Dudhmotisagar dairy

VRS foods

Parag Milk

Chitale Dairy

Amrelli Dairy

Panchmahal Dairy

NDDB

Kolar UHT plant

Bamul Dairy

Mysore Dairy

Mother dairy Bangalore

Mother Dairy Delhi

Sterling Agro

Bhole Baba Dairy

JK Dairy

Shimoga Milk Union

Aavin Dairy

Tirumala Dairy

Dodla Dairy

Hatsun Agro

Gokul Dairy

Amul Virar

Nestle

IDMC

GEA

Alfa Laval

Tetrapak

Food & Biotech

SSP Pvt.Ltd

Bosch

Hassia

GEA Procomac

Our Local & Global Customers: End-users & OEMs within Dairy Industry



Danfoss – A better tomorrow is driven by drives



ENGINEERING
TOMORROW

Danfoss

THANK YOU