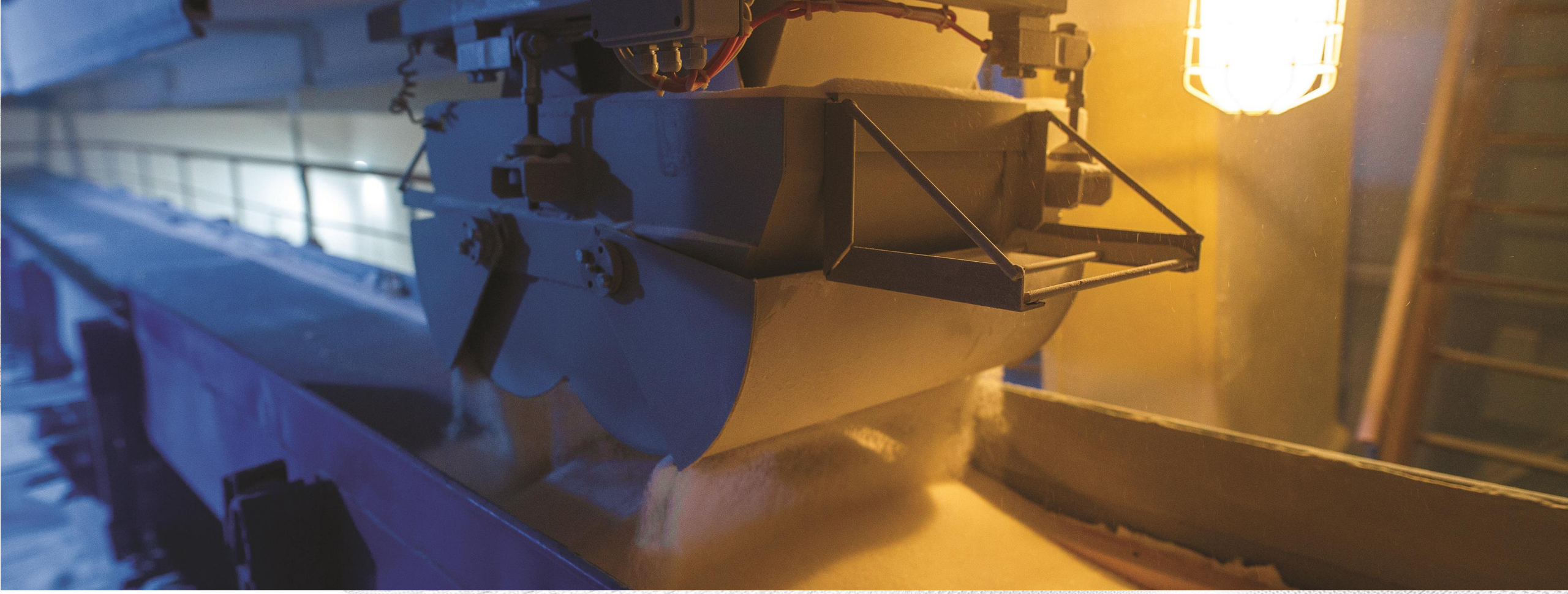


11TH SEP 2024, SUGAR PLANT SUMMIT 2024 (20TH EDITION), HICC, HYDERABAD

Enhancing System Efficiency with Drives & Motors

Brahmaji Rao

Associate Sales Director – Drives

Sugar processes benefiting from motors and drives

Controlling the details boosts productivity

1 Preparation and shredding (beet)

Goal: Sugar beets are cut and shredded into pieces

Applications: Rollers, shredders, conveyors, wash pumps

2 Milling (cane)

Goal: Shredded pieces of cane are fed through heavy rollers to extract cane juice

Applications: Pumps, rotation chamber

3 Diffusion (beet)

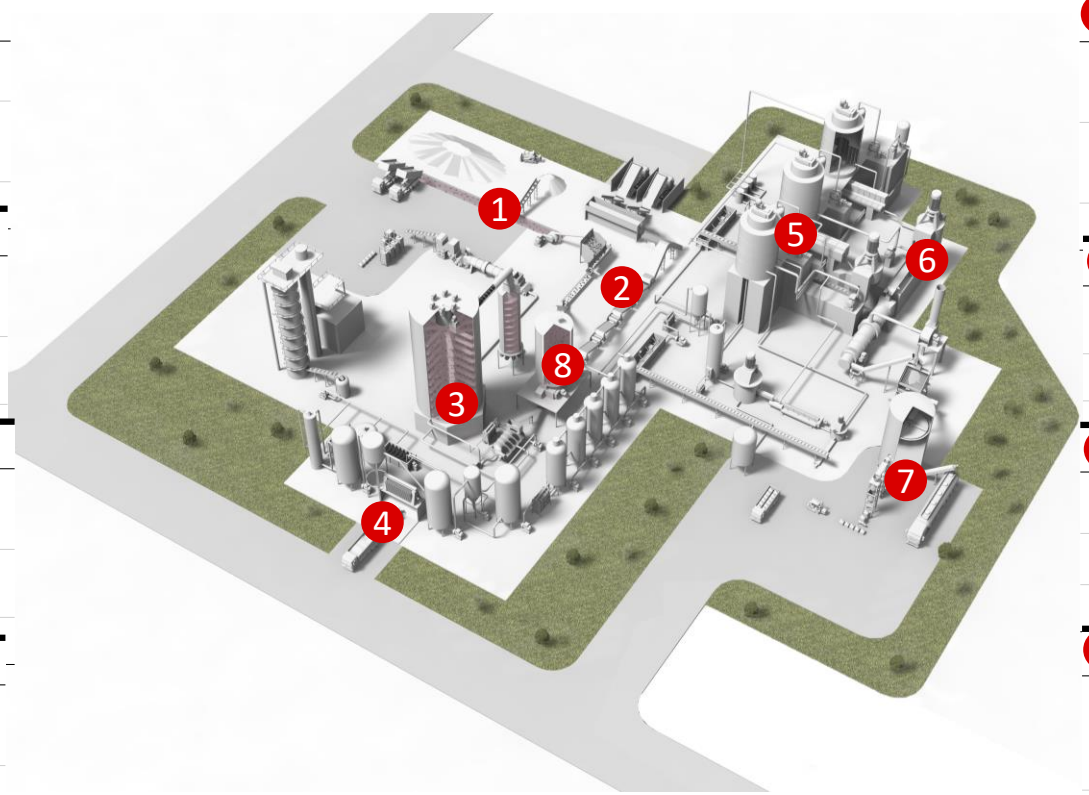
Goal: Thin slices of sugar plant are passed repeatedly through hot water to extract juice

Applications: Feedwater pumps, conveyors, mixers

4 Clarification/Carbonatation

Goal: Lime is added to the juice to control the pH and support removal of impurities

Applications: Mixers, pumps



5 Evaporation and crystallization

Goal: Juice is concentrated to increase thickness and then start crystallization in vacuum pans

Applications: Water and juice pumps, evaporator, vacuum boiling pan

6 Centrifuging

Goal: Separation of sugar crystals from molasses

Applications: Centrifuges, pumps

7 Filling and packaging

Goal: Primary packaging

Applications: Roll and belt conveyors

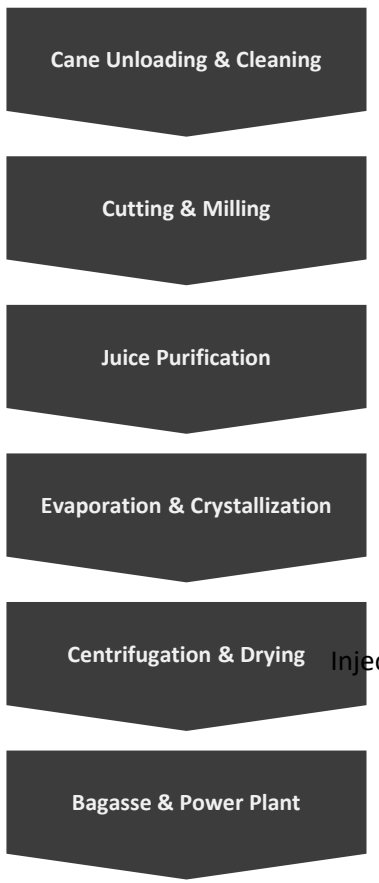
8 Byproducts for ethanol production

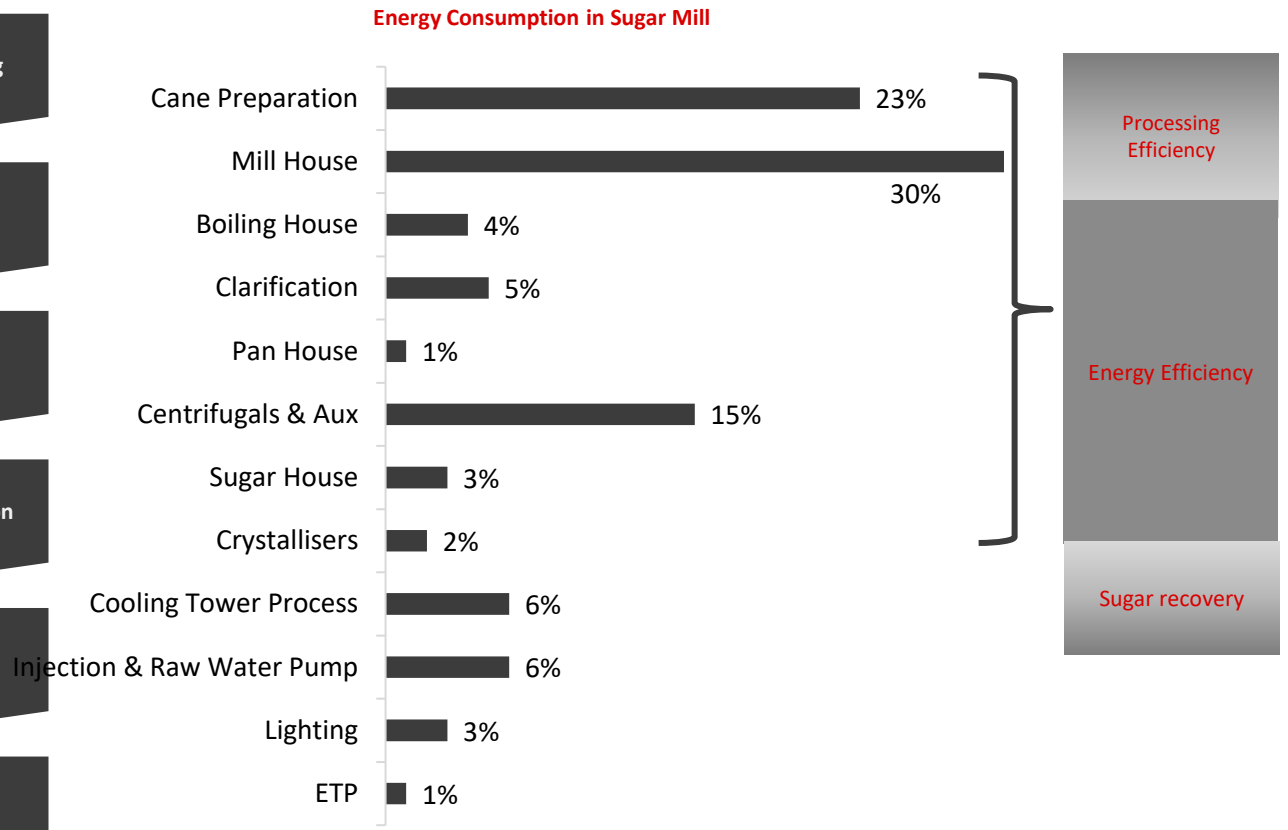
Goal: Bagasses are used for various products, for example to generate heat and electricity, while molasse can be used for ethanol production

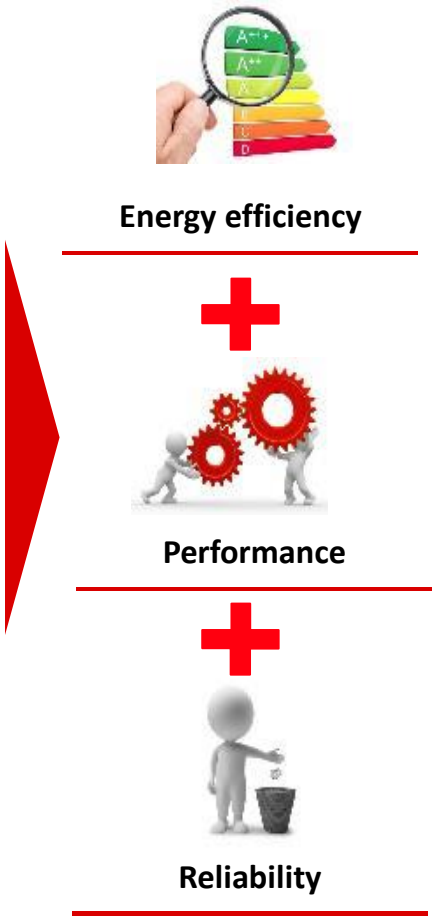
Applications: Conveyors, pumps, turbines

The Sugar Process

Downtime Is Critical - Cost Optimization In Focus







Source : ISSCT, SIMA

The Sugar Cane Process
Applications

Preparation & Milling

- Cane feeders
- Cane Carrier
- Hot water pumps
- Cane Shredders
- Crushing Mills
- Fiberizer
- Bagasse carriers
- Juice Pumps

Boiling

- Clarification
- Juice Pumps
- Dosing Pumps
- Evaporation
- Vacuum Pans
- Crystallization (Centrifuge)
- Syrup Pumps

White sugar production

- Separation
- Refining
- Drying
- Storing
- Packaging

Auxillary Units

CoGen Power Plant:

- Fans (ID / PA / FA)
- Feed water 7 MCW Pumps
- Boiler Feed Conveyors (Screw or Chain)
- Air Compressor
- Heat Exchangers (Cooling towers)

Distillation or Ethanol Plant:

- Conveyors
- Molasse Pumps
- Process Pumps etc

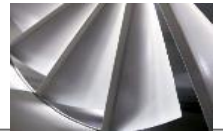
All these process will handle variable load's and most of them will need speed control as per process and hence benefit by using a VFD

General purpose, Industrial and Machinery drives

All compatible drives portfolio





		ACS180 0.37 to 22 kW	ACS380 0.3 to 22 kW	ACS560 0.75 to 160 kW	ACS580 0.57 to 500 kW	ACS880 0.55 to 5600 kW
Variable torque (VT)	Pumps, Fans, Agitators					
Basic constant torque (CT)	Compressors, belt conveyors, gates					
High torque requirements (CT)	Mixers, extruders, screw conveyors, centrifuges					
High precision, closed loop (CT)	Cranes, spindles, winding and unwinding					
High torque, precision and enhanced safety (CT)	Cranes, Winches, Kilns					
Position control and synchronizing	stacker cranes, rotary tables, converting machinery					

All-compatible drives portfolio

Learn it once. Use it everywhere

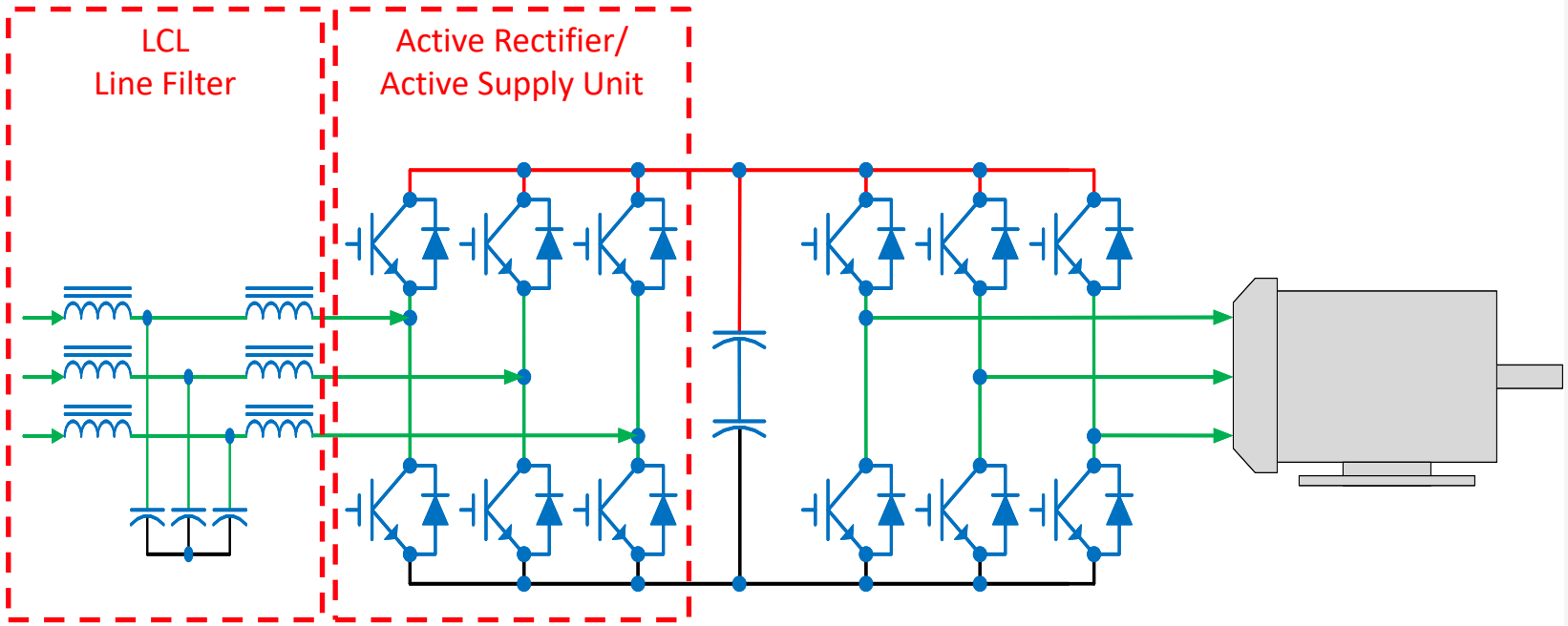
- All industries and applications
- For use with all types of AC motors
- From fractional-kilowatt to multi-megawatt
- From low voltage to medium voltage
- For all different kinds of environments

All-compatible drives for your entire installation

6-pulse Drive Vs Active Front-end Drives & Ultra Low Harmonic Drives

Active Front-end Drive

Operation Principle Active Front-end Drive



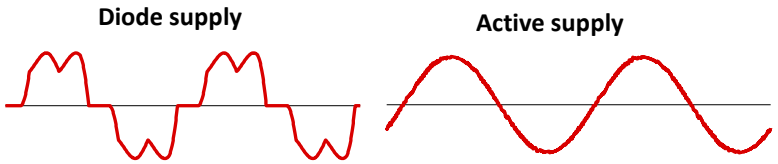
- Operates like an **Active Front End Drive**
- Drive has an:
  - **Line filter** to filter high frequency interference
  - **Active Supply Unit** (IGBT Supply Unit, ISU)
  - **Motor Inverter** (Motor Supply Unit/Inverter Unit, INU)
- Prevents harmonics from entering into the system
- All the functionality is built inside the drive. No extra components are needed

Ultra-low harmonic drives

Features & Benefits

Low Harmonic content, <3% THDi

The drive produces exceptionally low harmonic content and exceeds the requirements of harmonic recommendations, such as IEEE 519 and G5/4. The total harmonic current distortion is typically <3% in nominal situation and undistorted network.



Unity Power Factor, at all loads

ABB's ultra-low harmonic drives have been designed to be neutral from the network point of view. Drive reaches unity power factor. This high power-factor indicates that electrical energy is used efficiently.

Standard 6-pulse drive without input choke

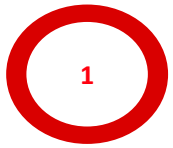
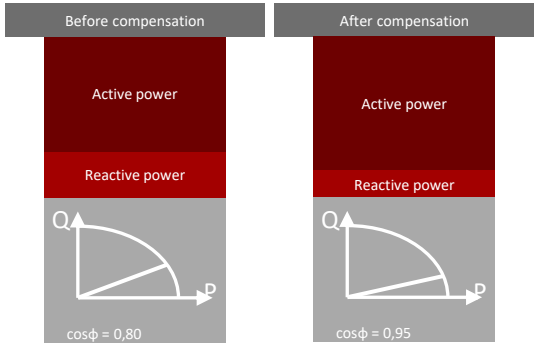


ABB ultra-low harmonnic drive

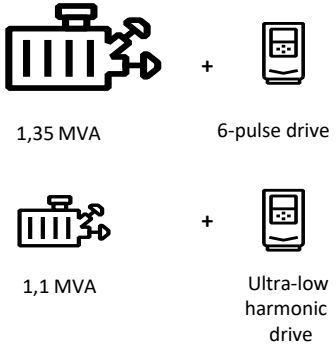
Reactive Power Control

ABB's ultra-low harmonic drives have the built-in feature for reactive power compensation, without any additional components



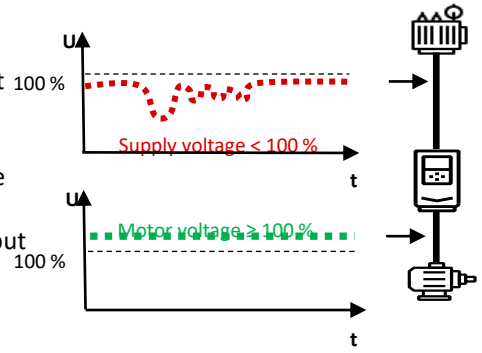
Reduced Demand ~25%

ABB's ultra-low Harmonic drives kills the cause for the harmonics at the source and hence the demand for the network also reduces by 25%

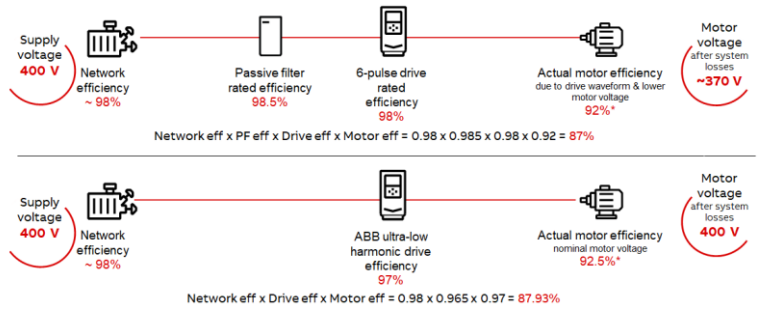


Immunity to network variations

The voltage stabilization feature in the ultra-low harmonic drives can boost the output voltage more than the source voltage. And ensures 100% voltage at motor terminals consistently despite of input fluctuations.



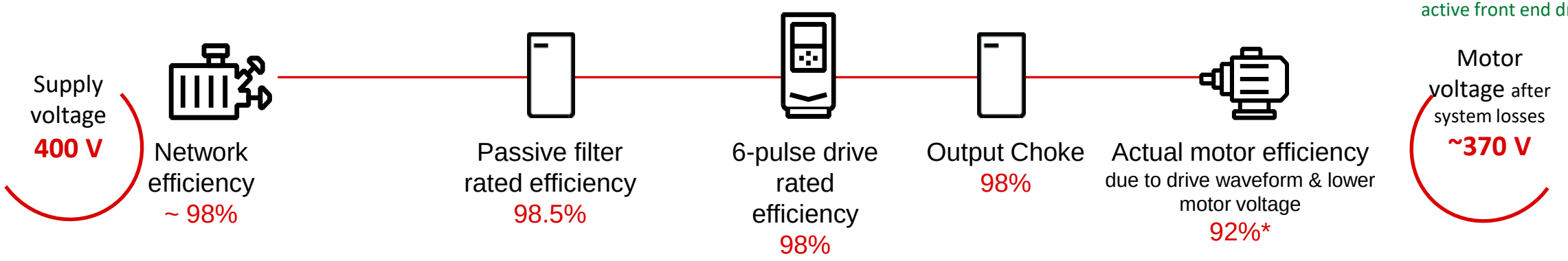
Improve System Efficiency



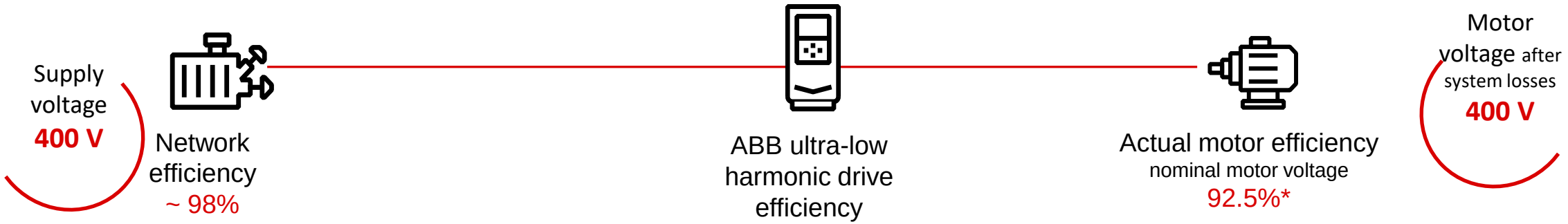
Ultra-low harmonic drives

System Efficiency

~2 to 3%
System Efficiency improvement if using ABB's active front end drives



Network eff x PF eff x Drive eff x Motor eff = 0.98 x 0.985 x 0.98 x 0.92 = 85.29%

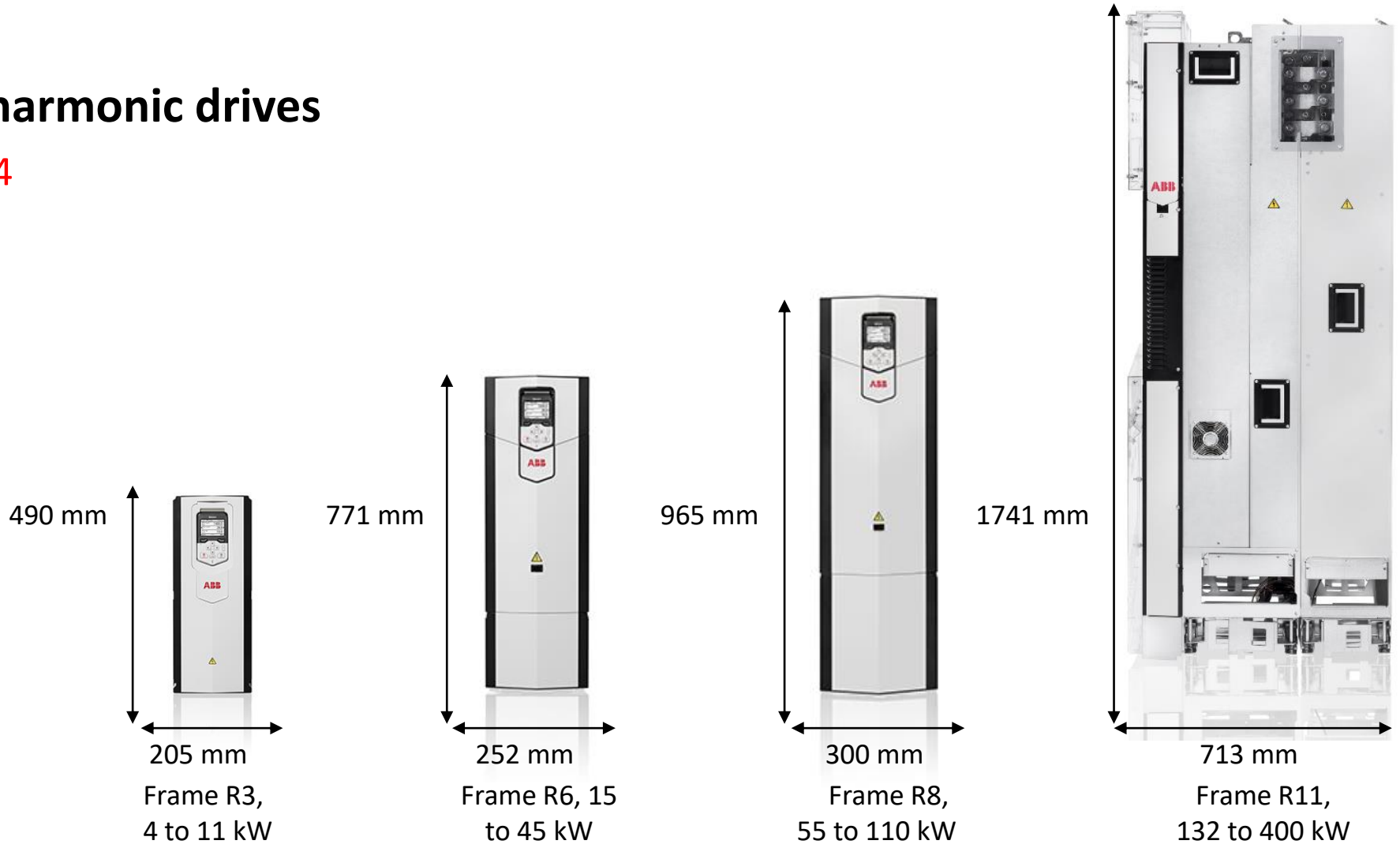


Network eff x Drive eff x Motor eff = 0.98 x 0.965 x 0.97 = 87.93%

* Standard IEC motor rated efficiency 93%

Ultra-low harmonic drives

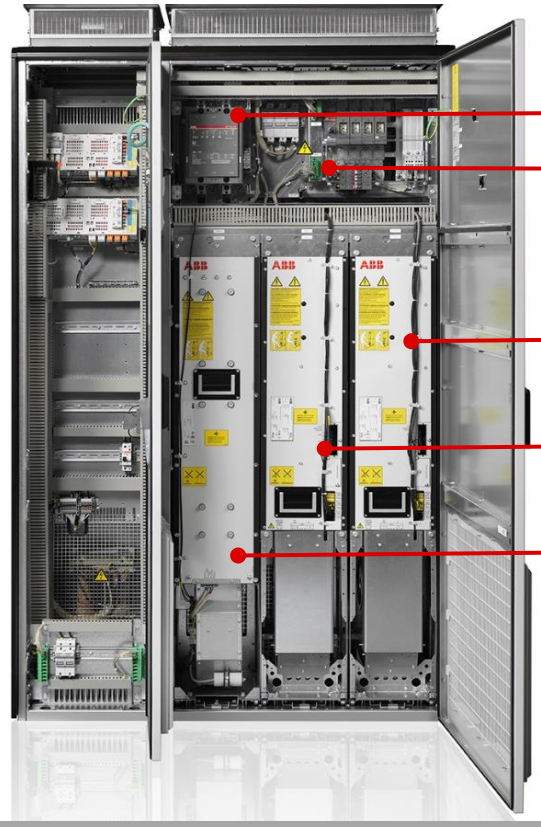
ACS880-31/34



Compact solution.
Everything in one integrated package.

Ultra-low harmonic drives

ACS880-34 Example >400kW



Line contactor

Main switch

Inverter unit (INU)

IGBT supply unit (ISU)

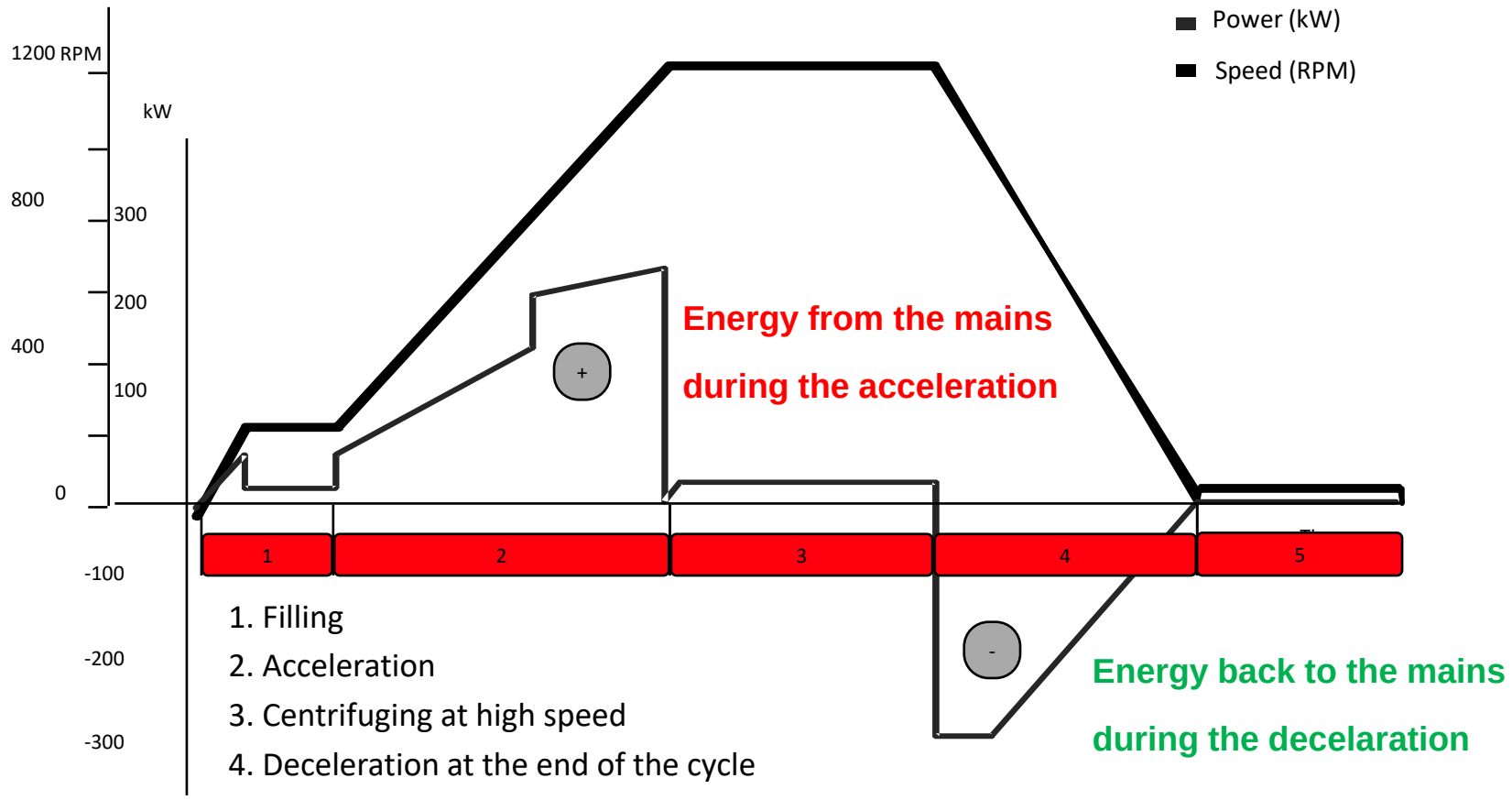
Line filter

IP22, IP42 and IP54 versions

Compact and robust design

Centrifuging

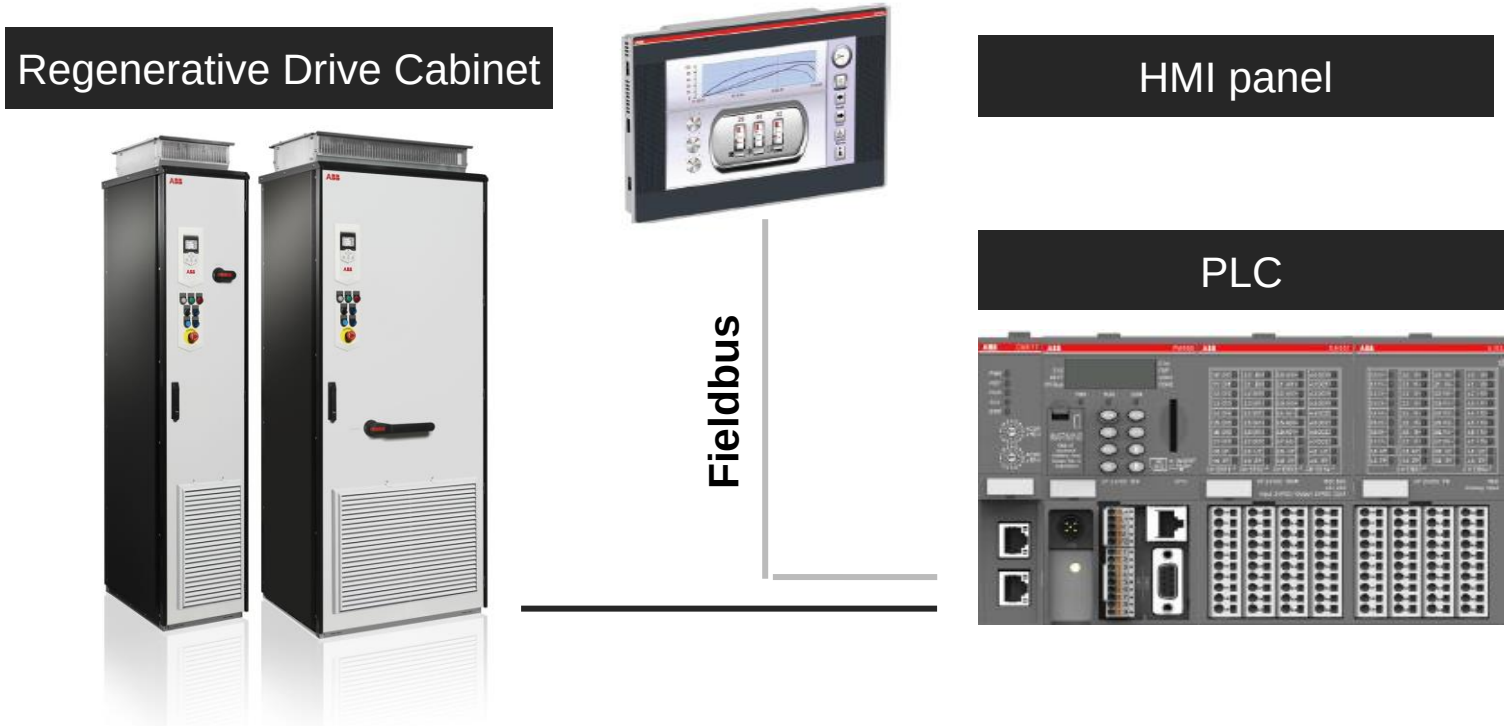
Regenerative Drives Speed and Power Curves



1. Filling
2. Acceleration
3. Centrifuging at high speed
4. Deceleration at the end of the cycle
5. Discharging and shaking the sugar off the drum

Centrifuge Machine

AC Drives for Centrifugal Machines



System Configuration: ACS880 Regenerative Drives with AC500 PLC (PM554) and HMI CP405

Ultra-low harmonic drives / Regenerative Drives

Quick Take Away Points

- **Clean Supply Network**
  - The **current harmonics are limited to < 3% THDi** and exceeds the requirement of Harmonic recommendation like IEEE519 & G54. **No additional Harmonic mitigation Filters required**
  - The **Total Power Factor** can be maintained at **unity at all loads**. Also supports **Reactive Power Compensation as built-in** features. **No addition Power Factor correction Panel required**.
  - **Full Regeneration (100%)** , **with ultra fast transition**, hence no additional DBRs required. **Energy Savings Solution for the system.**
- **Minimizes Down Time**
  - **Voltage Stabilization** immunes the network disturbances and the process
  - Maintains **Full Motor Voltage** consistently at Motor Terminals**, Efficient System**
- **Optimized Cost & Space**
  - Built-in Harmonic Mitigation, Power factor Correction **no need for any additional components for clean network**
  - No need of Over-dimensioning of the system, hence **optimizes the System Equipment Dimensions**
  - **Longer Motor Cable lengths** supported without any output choke.
  - **Available in IP00, IP21 & IP55** in **4 frames** for flexible selection as per usage and spares
- **Maximized motor performance and efficiency**
  - The drive is able to provide full motor voltage even if the supply voltage fluctuates.
  - Reduces the motor thermal load and increases motor lifetime
  - Higher Switching frequency (@ 4kHz) design consideration. Better Equipment life.

Why ABB Drives for Critical applications ? Mill , Sugar Centrifuge...

Why ABB Drives ?

- **All compatible drive platforms**
- **DTC Technology**
- **Switching frequency >**3 khz-
- **AC Choke**
- **Output choke** for all 690V/ Parallel VFD
- **Inbuilt ambient air inlet temparature sensor**
- **3 nos of Speed controlled fans from 250KW**
- **Modules on wheels**
- **Reduced run option**
- **100% busbar based Design**
- **12P DSU module with wheel from 250KW onwards**

Handling

Easier with Handle and Wheels

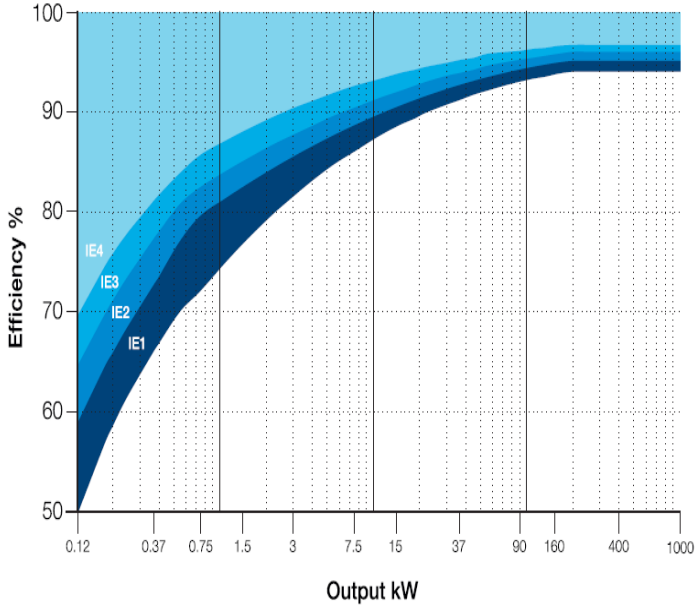
ACS880-04

ACS880-04/104

ACS880-104

Efficiency standards

- BIS (IS 12615) categorizes efficiency IE2 to IE4
- The IE4 motors have energy losses 15%-20% lower than IE3
- The IE3 motors have energy losses 15%-20% lower than IE2
- IS 12615 categorizes efficiency IE2 to IE4



1 — **IE1** Standard Efficiency

2 — **IE2** High Efficiency

IE2 minimum standard in India

3 — **IE3** Premium Efficiency

IE3 minimum standard in Europe

4 — **IE4** Super Premium Efficiency

From 2023, IE4 will be the minimum standard in Europe for motors between 75-200kW

5 — **IE5**[1] Ultra Premium Efficiency

1. The IE5 class has not been specified in the standard yet, but some manufacturers have already developed motors that will be compliant

ABB Ability™ Digital Powertrain

Powertrain

Drive

Motor

Mechanical power transmission e.g. bearing

Application e.g. pump

Data is gathered via NETA and Smart Sensors to the cloud

NETA-21

Smart Sensor

Cloud

ABB Ability™ Condition Monitoring