

Motor control centers: Upgrade or replace?

Modernization options



As electrical equipment ages and internal components become obsolete, decision makers must consider modernization — either upgrade or replacement. The advantages and disadvantages of both options must be analyzed to make the best decision for the specific situation.

Introduction

ABB has manufactured and sold motor control centers (MCCs) in the ANSI/NEMA market for many decades. Additionally, ABB has purchased other electrical equipment brands that manufactured ANSI/NEMA MCCs, including:

- BBC
- GE
- Gould
- ITE

Dating back to the mid-twentieth century, many millions of MCC buckets have been produced by these combined companies. Common brands still in operation today that ABB services frequently date back about 60 years and include:

- 7700-Line
- 8000-Line
- Spectra Line
- BBC / Gould / ITE 5600 product line
- Evolution E9000
- MNS MCC
- ReliaGear® LV MCC

In most applications, as electrical equipment ages, the integrity of major components, such as steel cabinetry and bus systems, is typically well maintained. Operating devices, such as circuit breakers, contactors and control devices, wear over time, so periodic replacement is common. When those devices become obsolete, maintenance of the electrical equipment becomes challenging. Specialty vendors may maintain inventory of used equipment or equipment that has never been used, but these options will eventually be depleted.

Over time, an aging electrical system may reach the point that reliability becomes unacceptably low and/or maintenance becomes too costly. When facing these issues, owners typically evaluate modernization options for their electrical equipment.

Two major modernization options generally exist: Upgrade or replacement. Both have distinct advantages and disadvantages, so some engineering analysis is required to make an optimal decision.

- 01 Molded case circuit breakers (MCCBs) are common obsolete components in MCCs. The SACE® Tmax® XT MCCB is an excellent modern replacement for obsolete MCCBs.
- 02 UMC100.3 motor protection relay
- 03 ACS580 variable frequency drive
- 04 PSTX softstarter
- 05 ReliaGear® LV MCC motor control center replacement

Upgrade

The upgrade option generally involves leaving the steel cabinetry and bus systems for the equipment in place. Major components, such as MCC buckets, are replaced to modernize the overall system.

To pursue this option, the owner should be satisfied that the remaining equipment is in good condition and supported with readily available spare parts.

Key features of the upgrade option include:

- Replacement of all obsolete components
- Lower cost
- Faster equipment delivery
- Quicker installation
- Shorter system outages

In most cases, the upgrade option will replace all obsolete components with modern ones, so the equipment is fully functional and supported. Additionally, most MCC buckets can be plugged in, so installation time is very minimal.

Other advantages may include:

- Carbon avoidance — Maintaining most of the equipment in place helps reduce waste of old product and procurement of new product. On average, 60% of carbon emissions are avoided.
- Maintain UL rating — When working with an original equipment manufacturer (OEM) for replacement, it is typically possible to retain the original UL 845 rating for MCCs.
- Introduction of new technology — When desired, new high technology devices can be installed to improve system operation and support network communication systems, including:
 - Advanced motor protection relays, such as the ABB UMC100.3, provide advanced protection and control of motor loads.
 - Variable frequency drives (VFDs), such as the ABB ACS580, control motor speed to optimize process operation and reduce energy consumption.
 - Softstarters (SSs), such as the ABB PSTX, can replace older technology for reduced voltage starters and provide many more features.



— 01



— 02

— 03

— 04



— 05

Replacement

The replacement option requires complete removal of the equipment. All components are replaced, including the steel cabinetry, bus system and all buckets.

Key features of the upgrade option include:

- Entirely new equipment
- Higher cost
- Longer equipment lead time
- Complex installation
- Longer system outage

The advantage of replacement is that the entire line-up of electrical equipment is replaced. The new product completely replaces the existing equipment. However, this is more complex and time consuming than upgrades. Several questions should be considered for installation, including:

- Will the new equipment fit in the footprint of the existing equipment?
- Does proper access exist to remove the old equipment and install new equipment?
- How will power and control cables be removed, stored and reinstalled?
- Is there a risk of damaging cable or a risk of cable lengths being too short?
- How much labor and downtime is required to remove equipment, install new equipment, terminate all cabling, and commission the new system?

Cost and time comparison: Upgrade vs. replacement

Sample procurement plan:

- Quantity = 10 of 10 HP size 1 FVNR starters
- Quantity = 5 of 25 HP size 2 FVNR starters
- Quantity = 3 of 40 HP size 3 FVNR starters
- Quantity = 5 of 100 A feeders
- Quantity = 3 of 200 A feeders

Type	Est. cost	Lead time
Upgrade	\$61,000	65 days
Replace	\$75,000	145 days

Specification notes

1. 480 V, 1200 A and 65 kA interrupting ratings.
2. Simple specifications with few options.
3. MLO incoming for the replacement line-up.
4. A new ReliaGear® LV MCC line-up for the design requires at least five sections. See Figure 6.

Installation and commissioning

Upgrading an MCC can typically be performed by the local maintenance staff with no outside support. Therefore, this cost for the upgrade is estimated as \$0.

Replacement of an MCC typically requires an electrical contractor to complete the work. This work has been estimated using the following assumptions:

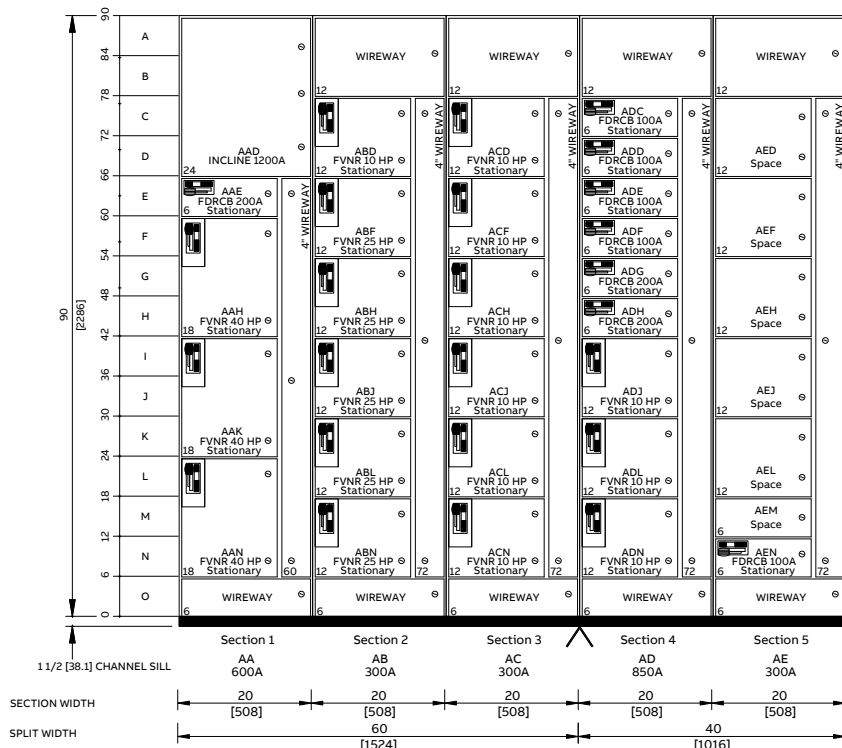
- Removal of five MCC sections and installation of five new MCC sections.
- 1.67 days for a crew of four electricians to complete all removal and installation: \$6,700.
- 20 hours of commissioning time for all start up and commissioning: \$4,500.

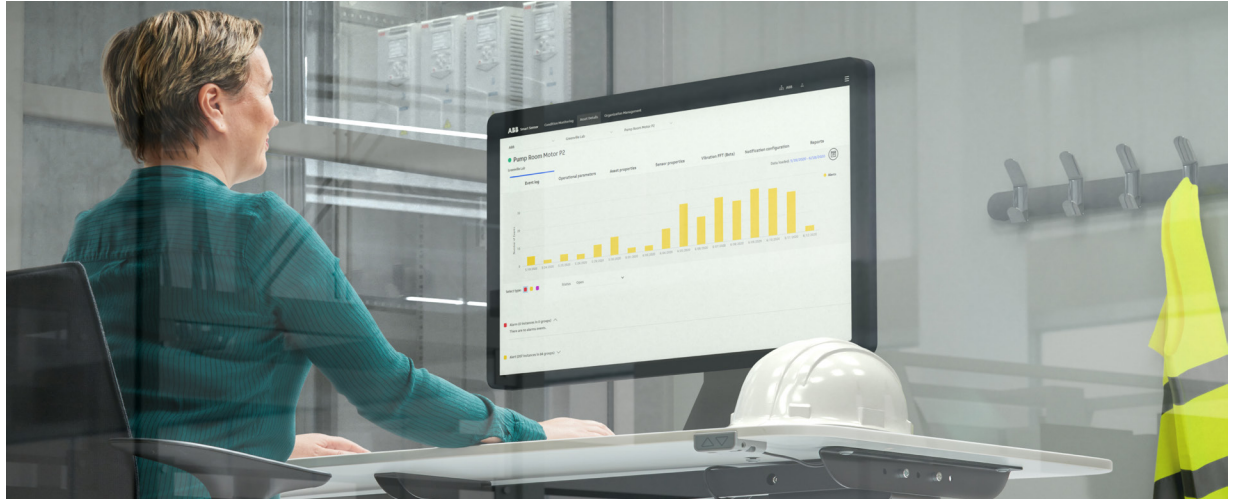
Type	Installation	Commissioning
Upgrade	\$0	\$0
Replace	\$6,700	\$4,500

Overall analysis

Type	Cost	Lead time
Upgrade	\$61,000	65 days
Replace	\$86,200	145 days
Difference	Upgrade saves \$25,200 or 29%	Upgrade saves 80 days in schedule

Note: The facility operator may also have additional costs for a four-day outage to install the new equipment. If so, those costs should also be considered.





07

Additional upgrade advantages

Reduce unplanned costs: Aging infrastructure may present hidden or difficult-to-quantify costs. These include:

- Unplanned or extended power outages
- Additional maintenance time
- Difficult sourcing efforts to locate and validate spare parts

Streamlined design: Rather than designing system functionality from scratch, existing system drawings can be used during an upgrade project. This allows new buckets to mimic the functionality of existing buckets, so that detailed design specifications are not required.

Minimize installation time: Outage planning can be quite simple for upgrade projects. The large majority of MCC buckets are designed to be plugged into the steel cabinetry of the MCC. This allows fast replacement of old buckets with new ones. It also eliminates the need to pull power and control cables out of the MCC. During a short, regularly scheduled outage, it may be possible for a maintenance team to replace and recommission many buckets.

Network communication: When advanced technology is introduced in an existing MCC, the ABB Ability™ system or similar systems may be interfaced with the MCC, making data available globally in the organization.

Modernization checklist

1. Planning: Start with data gathering. At minimum, gather the following data about existing systems:
 - a. Existing equipment nameplates
 - b. Existing equipment documentation and drawings
 - c. Undocumented system modifications
2. Analysis: Review available options and their effect on the site:
 - a. Options for replacement or upgrade
 - b. Site-specific requirements, such as:
 - i. Cost and schedule for outages
 - ii. Access for equipment removal and installation
 - iii. Budgeting: Cap Ex vs. Op Ex
3. Planning and scheduling
 - a. Outage schedule
 - b. Equipment lead time
 - c. Issuance of purchase orders
 - d. Planning of site labor as required

In conclusion, modernizing motor control centers can be a viable solution to help reduce costs and installation time, introduce new technology and features, and extend the life of the equipment.