MITSUBISHI ELECTRIC
Heating and Cooling

# Mitsubishi Electric Sales Canada

# MCA and MOP/MOCP Explanation

On Mitsubishi HVAC equipment, **MCA** and **MOP** or **MOCP** (MAXIMUM FUSE) values are listed on the *data plate* of the unit. This information is required for safely wiring and protecting the equipment. We first need to understand what **MCA** and **MOCP** are.

The minimum circuit ampacity (MCA) and maximum overcurrent protection (MOCP) ratings provide guidance for safely connecting field-wired equipment to the building power panel in Canada in compliance with Canadian Electrical Code and/or local applicable codes. Understanding these ratings, and their relationship to each other, is critical for proper wire size selection and circuit breaker sizes.

- **What is MCA?** Minimum Circuit Amps (MCA) is a calculated value that specifies the minimum main power **wire size**. More specifically, MCA is the highest steady-state electrical current that the HVAC unit should see when operating correctly. The minimum circuit ampacity (MCA) value is used to calculate the **minimum wire size** required for a field wired product. The wire size guarantees that the wiring will not overheat under the expected operating conditions. The selected wire size takes into account the normal current draw, ageing of components and anticipated faults.
- **Supply wire size must be rated to carry at least the amps shown as MCA**
- **MCA** values are shown in amperes (A) on the data plate.

- **What is MOCP/MOP?** Maximum Over-Current Protection is a calculated value provided that determines the maximum size of the over-current protection device **(fuse or breaker).** The maximum overcurrent protection (MOCP) is the maximum circuit breaker size that may be used to protect the WIRE and the equipment under anticipated fault conditions. The MOCP/MOP takes into account startup surges and component ageing.
- **The selected breaker size must be more than MCA rating but less than MOCP value.**
- **MOCP/MOP** value is shown in amperes (A) on the data plate

Mitsubishi Electric as manufacturers of the equipment and ETL /CSA Certification Company does all the calculations and publishes **MCA** and **MOCP** /**MOP** in both the equipment literature and on the unit data plate so the installers work is simplified. However, simple understanding of how these values are calculated helps with installation.

**Supply wire size must be rated to carry at least the amps shown as MCA.**

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**Minimum Current Ampacity (MCA)**

**MCA = [1.25 x Compressor Rated Current] + FAN FLA + OTHER current LOAD**

The Compressor Rated Current is referencing the FLA (full load amps) of the unit. This can be a source of confusion because this rated current is not the same as the compressor FLA shown on the nameplate of the compressor itself. Compressor Rated Current is determined during worst-case, high-current test conditions of the complete terminal unit, in accordance with UL1995. The FLA on the compressor nameplate is a rating from the compressor manufacturer and is not used in this calculation.

**Maximum Overcurrent Protection (MOCP)**

First, a basic calculation is made , and then a number of filters or conditions will alter the computed MOCP value to arrive at the final value that appears on a product nameplate. In short, the basic MOCP is calculated by multiplying the rated current of the largest compressor times 2.25, and adding in all other loads of 1.0 amp or more that could be in operation at the same time.

**MOCP = [2.25 x (Compressor Rated Current)] + (Other Motor Loads) + (All other Loads)**

**Filter 1:** If the MOCP value is not an even multiple of 5, the MOCP is rounded down to the nearest standard breaker or fuse size.

**Filter 2:** If the MOCP is less than the MCA, the MOCP is made equal to the MCA and then rounded up to the nearest standard fuse size, typically a multiple of 5. In other words, the MOCP shall not be less than the MCA.

**Filter 3:** If the MOCP is less than 15, it shall be rounded up to 15 amps. This is the minimum size of fuse or circuit breaker permitted by code.

**Note:** some recent changes do not apply filters to MOP calculated values and are listed as calculated values.Calculations are based on the national standard for Heating & Cooling Equipment, UL1995, a.k.a. CSA-C22.2 No. 236. The calculations for the MCA and MOCP are based on requirements of NFPA 70, the National Electrical Code (NEC) and CSA C22.1, the Canadian Electrical Code (CEC).

*The MCA is the minimum wire size* needed to guarantee that the wiring will not overheat under all operating conditions for the life of the product.

*The MOCP is the maximum allowable circuit breaker size* that will properly disconnect power to the equipment under any anticipated fault condition.

Minimum circuit ampacity (MCA) and maximum overcurrent protection (MOCP) are required information to install field wired equipment correctly. As their names indicate, the ratings will tell you the minimum wire size and maximum circuit breaker size allowed for the equipment. Higher currents have led to a greater awareness of the risks of overcurrent and fires. The system of MCA and MOCP were developed to reduce fire risk.

A proper ground provides the safety factor for all equipment. Even with properly sized wires and circuit breakers does not matter if the unit is not **properly grounded.** A proper ground provides the safe operation for all equipment. A *short to ground* cannot occur if there is no ground. All units need to have the properly sized wire, circuit breaker, and ground. The ground also provides protection for the equipment during power surge and voltage fluctuations. The ground also enables noise filter circuits to work properly in inverter equipment.

TERMINOLGY:

**MOCP /MOP** (maximum overcurrent protection device) = maximum breaker or fuse rating.

**FLA** (full load amps) = **RLA** (running load amps) = used for MOCP calculations.

**LRA** (locked rotor amps) is what a motor will draw with a locked rotor, which will very nearly equal what it will draw during starting. This will usually be about 700% of full load amps and will last for about 6 seconds.