

**INTRODUCTION:**

The X-Drive operators and the HG\*\* series hinges were designed to meet all the feature and performance requirements of today's demanding Casement and Awning window markets. These products were designed to be installed together as a system to achieve optimum performance levels.

**IMPORTANT NOTES:**

The Hardware Application Matrix (Table 1.0) below should be used as a guide to select hardware for different window applications. This information is based on extensive load testing of all the various hardware combinations using protocol defined by the AAMA/WDMA/CSA101/1.S.2/A440-11 Hardware Load Test. It is important to note that there are many factors that affect the maximum size window that can be safely manufactured as well as its level of performance. These include:

- Sash and frame rigidity
- Sash and frame strength
- Fastener holding strength
- Window tolerances
- Sash sag
- Weather tightness
- Weather r-strip interference and drag

Due to the reasons highlighted above, Roto recommends evaluating the entire window system before producing the largest frame listed in Table 1.0 below. Structural & application testing must be thoroughly conducted by the window manufacturer, in accordance with their requirements prior to implementation of these recommendations.

The size and weight recommendations listed in Table 1.0 are based on standard mounting locations that are specified by Roto's Sales Engineering Department. The ease of operation, service life, load capacity, and hence the maximum window size that can be produced, are strongly influenced by the mounting location of the hardware. The information provided in the table assumes that these mounting specifications have been adhered to although different mounting locations and hardware combinations are possible. Please contact a member of Roto's experienced Sales Engineering Group to review your specific window requirements.

**Table 1.0 Hardware Application Matrix for Casement Window Hardware Load Test**

(AAMA/WDMA/CSA101/1.S.2/A440-11, section 9.3.6.5)

**Performance Class R:** The Maximum Frame Size and Sash Weight are listed in Table 1.0

**Performance Classes LC, C, HC, AW:** The Frame Area (width x height) listed in the Table 1.0 must be reduced by 20%

X-Drive Operators (OP06 and OP08)	13" & 14" Washability Hinges (HG05, HG06 or HG09)	10" Washability Hinges (HG05, HG06 or HG09)	10" Egress Hinges (HG05 or HG06)	Approximate Minimum Frame Width
Dual Arm	40"W x 84" H (108lb)	32"W x 66" H (70lb)	Not Recommended	24"
Narrow Dual Arm	32"W x 76" H (85lb)	30"W x 66" H (60lb)	Not Recommended	20"
Split Arm (see note 3)	32"W x 72" H (70lb)	24"W x 64" H (50lb)	Not Recommended	16"
Inverted Split Arm (see note 3)	32"W x 72" H (70lb)	24"W x 64" H (50lb)	Not Recommended	16"
Single Arm 13.5"	Not Recommended	Not Recommended	30"W x 66" H (75lb)	24"
Single Arm 9.5"	Not Recommended	Not Recommended	26"W x 66" H (65lb)	20"
Single Arm 7.5"	Not Recommended	Not Recommended	24"W x 60" H (50lb)	16"
Single Arm 5.5"	Not Recommended	Not Recommended	16"W x 60" H (45lb)	12"
Awning (see notes 4 and 5)	60"W x 36" H max. 18"W x 18"H min. (50lb)	60"W x 18" H max. 18"W x 14"H min. (40lb)	60"W x 18" H max. 18"W x 14"H min. (30lb)	18"

**Notes:**

- 1) Maximum frame size and sash weight is shown for each operator and hinge combination. Sash weight is the maximum allowed in order to pass the NAFS Hardware Load Test.
- 2) To ensure ease of operation, the specific application mounting locations identified on the following pages must be followed. Contact the Roto Sales Engineering Group for further assistance regarding your specific application.
- 3) It is recommended that a hinge stop be used on any casement window which uses a split arm operator unless a limit device is already being used.
- 4) The Hardware Load Test is not applicable to Awning windows. The sash weight listed in Table 1.0 represents the maximum for best operation.
- 5) For Awning windows less than 18" high use of a restricted Awning Operator may be required. Contact the Sales Engineering Group for further assistance regarding your specific application. Other restricted opening Awning variants are available for various code requirements.
- 6) It is recommended that the sash width does not exceed 66% of the sash height for proper performance
- 7) To ensure optimum hardware function and longevity, Roto recommends that the handle torque to open or close a sash does not exceed 35 in-lb.