NOTE: TYPICALLY PRE-ENGINEERED BUILDINGS DO NOT HAVE RIGID FRAME RAFTERS (AS SHOWN) AT END WALLS.
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This manual has been prepared to assist both the salesperson and structural engineer to better identify the support structure required for an overhead supported backstop, as adapted to a pre-engineered building. Due to the fast-track nature in the erection of pre-engineered buildings, the backstop support must be taken into consideration early in the project. Pricing of the backstop superstructure can vary widely, dependent upon whether the backstop can be attached directly to the purlins, cradled about a rigid frame member, attached to steel-in-place by a general contractor, or span frames with bridged tubing supplied by Porter.

This manual in no way implies the exclusion of the pre-engineered (metal) building fabricator, architect or structural engineer. Building attachments, as detailed in this manual, may not necessarily comply with the design load of the pre-engineered building structure. For example, the structural engineer (and/or metal building fabricator) may not allow any attachments for the backstop superstructure to the secondary ("Z" purlin) framing members. In a case such as this, either additional structural support members ("I" beams), supplied and installed by others, or bridged tubing (supplied by Porter) to span the rigid frames, will be required.

As a point of clarification, the terms "Pre-engineered Building," "Metal Frame Building" and "Rigid Frame Building" are all interchangeable for the sake of discussion in this manual. "Steel-in-place" refers to additional structural members required to support the backstops, which must be designed and designated by the architect or structural engineer, and erected by the general contractor. Please note, however, tube steel is still provided by Porter to span the steel-in-place. It has been Porter's vast experience that when steel is placed in a predetermined location, the backstop may not necessarily align correctly within the basketball court layout. The tube superstructure supplied by Porter provides adjustability during the installation process, and acts as bridging across the steel-framing members.
For simplicity in illustrating the various types of superstructures, all backstop models depicted in this manual are shown as stationary, rear-braced backstops. It is critical to take into consideration which model backstop will be utilized in your particular project. Obviously, the superstructure supports will vary, depending upon the model selected. A brief guide illustrating various backstop models is listed in this section. A comprehensive description, with illustrations, can be found in Porter’s "Designer’s Technical Manual."

Each building application is unique, with this guide serving only as a reference source. Differences in building material, design, lighting, and HVAC locations will require customization of the standard superstructure designs illustrated. Your Porter representative has the entire Porter engineering team to review your particular design needs. As you have come to expect, the Porter design and product is backed by over 130 years’ experience and expertise. Let our team help you with your next project.

*Porter Athletic Equipment Company*
TYPICAL RIGID FRAME CONSTRUCTION

EAVE STRUT

"Z" PURLINS

SIDE WALL GIRDERS

"Z" PURLIN

SIDE WALL

RIGID FRAMEOLUMNS

RIGID FRAME RAFTERS

NOTE: TYPICALLY PRE-ENGINEERED BUILDINGS DO NOT HAVE RIGID FRAME RAFTERS (AS SHOWN) AT END WALLS.
1. This is a permanent structure.

2. The building structure must withstand the load and lateral force of the backstop, as detailed, for a safe and rigid installation. Porter strongly recommends review of the backstop superstructure by the architect or the building's structural engineer of record.

3. Additional structural support may be added, as required, by the architect/structural engineer. Additional steel members, if required, are to be specified by the architect, located by Porter and installed by the general contractor. This must be specified in the architectural drawings/specifications, as required.

4. On folding units, additional support structure is required on a "17" series backstop for the pulley location, as opposed to the self-contained pulley structure on other folding units (see Detail "A"). The "17" series requires three points of attachment, as opposed to two.
BACKSTOP FIELD CHECK LIST FOR RIGID FRAME BUILDINGS

Information not verified will be assumed correct. Porter Athletic Equipment Company will not accept responsibility for errors resulting from field checks without complete verification.

Sketch in the following information on the field check sheet and submittal drawings.

1. Transfer all architects comments/corrections to this set of submittal drawings.
2. Check distance of wall-to-wall dimensions, length and width of gymnasium.
3. Check distance from first rigid frame to wall and center-to-center dimensions of all other members.
4. Check distance of first purlin to wall and center-to-center of all other purlins.
5. Check size of attachment members. Designate type and size:
   A. Rigid Frame Flange: Width ____________ Thickness ________________
   B. "Z" Purlin: Height _______________ Gauge __________________
   C. "C" Purlin: Height _______________ Gauge __________________
6. Give description of wall and check with architect to determine if backstop superstructure and/or winch pulley may be attached to wall.
7. Check height of beams at attachment points of backstop superstructure. (Is finished floor in place? If not, check thickness with G.C. and specify.) Check beam height at wall and at center of room for slope or camber of beams.
8. Check with general contractor if a ceiling is to be installed. If so, request the following:
   A. Type of ceiling ____________________________________________________
   B. Ceiling height from finished floor _________________________________
   C. Schedule for installation of ceiling _________________________________
9. If heating ducts and lights have not been installed, check with general contractor on locations, heights and sizes to ensure that there will not be an interference with the installation and folding of the backstops.
10. Check with owner or architect to determine the best location for the manual winches. Ideally, winches should be located directly below structural ceiling member so that wall pulley may be affixed to it, thus keeping load of backstop off wall at this point.
11. If electric operation is specified, give general contractor copy of wiring diagram and specify the location of the electric winch. In most cases the winch will be located directly above the backboard, as located on the floor plan. Check keyswitch box size.
12. If court markings are not in place, check with field architect on location of backstops as per architect's floor plan. (Note minimum face of bank-to-wall dimensions on backstop drawings.)
13. Check sight lines from top row of balcony bleachers. (Recommend direct attached forward fold backstops when sight line problem exists.)
14. Check with contractor on scheduling of shipment and installation of backstops.
**OPTION A - STEEL-IN-PLACE**

"I" beams are to be supplied and erected in place by others. This option is for backstop units centered on the ridge. Ideally, the "I" beam flanges are to be parallel to the floor. Special provisions may be required for the "I" beam at the end wall attachment.

**END WALL ATTACHMENT**
May require additional steel support.

**TYPICALLY 18' TO 25' SPAN**

**CONTACT FACTORY**
Rep for location

**ALTERNATE**
"I" beams on rigid frame camber.
("I" beams may also be located above or below rigid frame.)

**PREFERRED**
"I" beam flanges are parallel to the floor.

**CLAMP CONNECTION**
(TO "I" BEAMS) AND SUPPORT TUBING supplied by PORTER.

**DETAIL A**

GIRDER CLAMP ASSEMBLY

ONE (1) 1 1/2" THREADED ROD

TWO (2) 1/2" U-BOLTS

3-1/2" ACTUAL O.D. TUBING

(FOR FLANGE THICKNESS OF 1/2" OR LESS)
**BACKBOARD PARALLEL WITH MAIN FRAME (OPTION B)**

**OPTION B - STEEL IN-PLACE**

"1" BEAMS ARE TO BE SUPPLIED AND ERECTED IN PLACE BY OTHERS. THIS OPTION IS FOR BACKSTOP UNITS CENTERED ON THE RIDGE. IDEALLY, THE "1" BEAM FLANGES ARE TO BE PARALLEL TO THE FLOOR (SEE OPTION A). SPECIAL PROVISIONS MAY BE REQUIRED FOR THE "1" BEAM AT THE END WALL ATTACHMENT.

"1" BEAMS ON TOP OF RIGID FRAME, IN THE SAME PLANE AS THE "Z" PURLINS.

*CONTACT FACTORY REP FOR LOCATION*

"1" BEAMS BY OTHERS

CLAMP CONNECTION (TO "1" BEAMS) AND SUPPORT TUBING SUPPLIED by PORTER.
STEEL-IN-PLACE BACKBOARD PERPENDICULAR WITH MAIN FRAME (OPTION C)

ALTERNATE BEAM LOCATION

CONTACT FACTORY REP FOR LOCATION

OFFSET AND PERPENDICULAR TO THE MAIN FRAME

CLAMP CONNECTION TO "1" BEAMS AND SUPPORT TUBING SUPPLIED BY PORTER.

1" BEAMS ARE TO BE SUPPLIED AND ERECTED BY OTHERS. THIS OPTION IS FOR BACKBOARD UNIT PERPENDICULAR TO, AND OFFSET FROM, THE MAIN FRAME. AS SHOWN, OR EITHER ABOVE OR BELOW THE FRAME, AS SHOWN IN THE ALTERNATE LOCATION.

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THIS PRINT IS THE PROPERTY OF PORTER ATHLETIC EQUIPMENT COMPANY AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION
ATTACHMENT OF SUPERSTRUCTURE DIRECTLY TO PURLINS

BACKBOARD PARALLEL TO PURLINS, BACKSTOP LOCATIONS BETWEEN RIGID FRAME MEMBERS.

OFFSET AND PERPENDICULAR TO THE MAIN FRAME.

CLAMP CONNECTION (1/4" PURLINS) AND SUPPORT TUBING (1/2") SUPPLIED BY PORTER.

1" PURLIN ATTACHMENT DETAIL

SUPERSTRUCTURE by PORTER
BACKBOARD PERPENDICULAR TO MAIN FRAME (OPTION D)

DRAWING BY AB
CHECKED BY GS

RFS

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WORLD LEADER IN QUALITY SPORTS EQUIPMENT
2500 S. 20th AVENUE
BROADVIEW, ILLINOIS 60155
www.porterath.com
FULL CRADLE FROM RIGID FRAME

CLAMP CONNECTION (TO "Z" PURLINS & RIGID FRAME) AND SUPPORT TUBING SUPPLIED BY PORTER.

"Z" PURLIN ATTACHMENT DETAIL

FULL CRADLE TO RIGID FRAME (OPTION J)

SUPERSTRUCTURE by PORTER

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BROADVIEW, ILLINOIS 60155
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GS
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REVISION
DATE
PORTER No.
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CUSTOMER No.

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BRIDGED PIPE SPAN WITH KNEE BRACES

BACKBOARD PARALLEL TO PURLINS.

UP TO 25' SPAN WITH KNEE BRACING FROM THE RIGID FRAME. BRIDGING IS ADDED DEPENDING UPON SPAN LENGTH, DEPTH OF RIGID FRAME, AND PROXIMITY OF BACKSTOPS TO THE RIGID FRAME. KNEE BRACING WILL INCREASE THE RIGIDITY OF THE SUPPORT SPAN.

CLAMP CONNECTION (TO RIGID FRAME) AND SUPPORT TUBING SUPPLIED BY PORTER.

SEE DETAIL A

TYPICALLY 20' TO 25' SPAN

KCLP 58001 002
PRECISION DIE-FORMED GIRDER CLAMP

TWO (2) 1/2" U-BOLTS
3-1/2" ACTUAL O.D. TUBING
(FOR FLANGE THICKNESS OF 1/2" OR LESS)

GIRDER CLAMP ASSEMBLY

DETAIL A
As a precautionary note, only a minority of pre-engineered buildings is suitable for the installation of wall-mounted backstops. A bearing wall, usually of CMU construction, must be available for thru-bolting the backstop attachment (anchor) points above the finished floor. Typically, pre-engineered buildings will have a block wall (CMU) construction to only 10' above the finished floor, or no block wall at all. A wall-mounted backstop is not recommended unless a floor-to-ceiling block wall capable of supporting the load of the backstop unit is available, or the architect designs supports in place. A column-mounted backstop is available and is ideal for the pre-engineered building environment. The column-mounted backstop (Model No. 311) is detailed on page 27.

**POINTS TO REMEMBER**

1. The wall-mounted backstop is a permanent structure.

2. Backstop must be anchored to a vertical wall capable of supporting the unit at the extension required. Typically, pre-engineered buildings do not have block walls from floor to ceiling.

3. Thru-bolting of at least the top two wall locations and chain supports is required on all installations.

4. On non-folding backstops (Model No. 312), the diagonal support chains may be secured to the roof framing, if necessary, to reduce wall loading. Contact the factory for additional hardware requirements.

5. On stationary backstops (Model No. 312), offsets in the wall construction can be compensated for by length of backstop extension pipes (specify).

6. On folding backstops (Model 219 & Model 220), attachments at wall must be in alignment (no offsets or projections). If offsets exist, blocking and/or additional structure support must be supplied (by others) to compensate for the offset.

7. On stationary backstops (Model 312), attachment can be made to the rigid frame column if a block wall does not exist. Contact the factory for additional hardware requirements. A Model No. 311 column-mount may also be specified where only a minimal extension is required.

8. It is strongly recommended that the architect/building structural engineer approve all building attachments.
The following two pages provide static equivalent loading of a Model No. 923 backward fold backstop at attachment heights of 21' and 28'. Weight intensive options such as a glass bank and height adjuster are included to provide a "worst case scenario." Superstructure support is not included in the computer-generated loads that typically can add 200 to 300 pounds. The loads are provided for a preliminary "ball park" figure only. Your Porter representative can provide computer generated, job specific loads of the 900 line series backstop ranging from 18' to 32' attachment heights.
WEIGHT LOAD CALCULATIONS (WITH BANK DOWN)

BACKSTOP'S TOTAL WEIGHT LOAD = 594 lbs (WEIGHT OF REAR BRACE + WEIGHT OF MAST + WEIGHT OF BANK

WEIGHT LOAD AT POINT "A" = (WEIGHT OF REAR BRACE / 2) + WEIGHT OF MAST + WEIGHT OF BANK

WEIGHT LOAD AT POINT "B" = (WEIGHT OF REAR BRACE / 2) + WEIGHT OF PULLEY

SEISMIC FACTORED MOMENTS AND SUM OF MOMENTS FOR BACKSTOP ELEMENTS

SEISMIC FACTOR = 0.7 (VARIES WITH SEISMIC ZONE, rigidITY OF SUPPORT & ROOM USE)

WEIGHT OF BANK (MB) = 264 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF BANK (DB) = 1788 ft.lbs SEISMIC MOMENT (MB) (FT.LBS)

WEIGHT OF REAR BRACE (MWB) = 34 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF FRONT BRACE (DFB) = 115 ft.lbs SEISMIC MOMENT (MWB) (FT.LBS)

WEIGHT OF MAST (MM) = 260 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF MAST (DM) = 996 ft.lbs SEISMIC MOMENT (MM) (FT.LBS)

WB + WRB + WM = BACKSTOP'S TOTAL WEIGHT LOAD = 2900 ft.lbs SUM OF THE MOMENTS = MB + MFB + WM

POINTER REACTIONS FROM WEIGHT LOADS AND SEISMIC WITH BANK DOWN

REACTIONS AT HINGE LINE AT POINT A FROM WEIGHT LOADS AND SEISMIC PARALLEL TO BANK (FIG. 2)

BANK DOWN

R\text{v-a} = VERTICAL REACTIONS AT POINT A: 798 lbs = \frac{WEIGHT LOAD AT POINT "A"}{2 SUPPORTS} + \frac{SUM OF THE MOMENTS}{DISTANCE BETWEEN SUPPORTS (A\text{a} - A\text{b})}

R\text{h-a} = HORIZONTAL REACTION AT POINT A: 206 lbs = \frac{BACKSTOP'S TOTAL WEIGHT LOAD X SEISMIC FACTOR}{2 SUPPORTS}

REACTIONS AT HINGE LINE AT POINT B FROM WEIGHT LOADS AND SEISMIC PERPENDICULAR TO BANK (FIG. 1)

BANK DOWN

R\text{v-b} = VERTICAL REACTION AT POINT B: 486 lbs = \frac{WEIGHT OF REAR BRACE}{2 SUPPORTS} + \frac{WEIGHT OF PULLEY \pm SUM OF THE MOMENTS}{DISTANCE BETWEEN SUPPORTS (A\text{-}B)}

R\text{h-b} = HORIZONTAL REACTION AT POINT B: 300 lbs = \frac{SUM OF THE MOMENTS}{DISTANCE TO MIDPOINT OF REAR BRACE X 2}

POINTER REACTIONS FROM WEIGHT LOADS AND SEISMIC WITH BANK UP

HOST CABLE TENSION AT POINT B: 618 lbs = \frac{SUM OF THE MOMENTS}{SEISMIC FACTOR X DISTANCE FROM A TO B}

REACTIONS AT HINGE LINE AT POINT A FROM WEIGHT LOADS AND SEISMIC PARALLEL TO BANK (FIG. 2)

BANK UP

R\text{v-a} = VERTICAL REACTION AT POINT A: -12 lbs = \frac{BACKSTOP'S TOTAL WEIGHT LOAD + HOST CABLE TENSION}{2 SUPPORTS}

R\text{h-a} = HORIZONTAL REACTION AT POINT A: 527 lbs = \frac{SUM OF THE MOMENTS}{DISTANCE FROM A\text{a} TO A\text{b}}

REACTIONS AT HINGE LINE AT POINT B FROM WEIGHT LOADS AND SEISMIC PARALLEL TO BANK (FIG. 1)

BANK UP

R\text{v-b} = VERTICAL REACTION AT POINT B: 671 lbs = \frac{-HOST CABLE TENSION}{2 SUPPORTS} + \frac{WEIGHT OF REAR BRACE}{2 SUPPORTS} + \frac{WEIGHT OF PULLEY}{2 SUPPORTS}

R\text{h-b} = HORIZONTAL REACTION AT POINT B: 618 lbs = HOST CABLE TENSION
WEIGHT LOAD CALCULATIONS (WITH BANK DOWN)

BACKSTOP'S TOTAL WEIGHT LOAD = 747 lbs (WEIGHT OF REAR BRACE + WEIGHT OF MAST + WEIGHT OF BANK)

WEIGHT LOAD AT POINT "A" = \( \frac{667 \text{ lbs} \left( \frac{\text{WEIGHT OF REAR BRACE}}{2} \right) + \text{WEIGHT OF MAST} + \text{WEIGHT OF BANK}}{} \)

WEIGHT LOAD AT POINT "B" = 80 lbs \( \frac{\text{WEIGHT OF REAR BRACE}}{2} \)

SEISMIC FACTORED MOMENTS AND SUM OF MOMENTS FOR BACKSTOP ELEMENTS

SEISMIC FACTOR = 0.7 (VARIES WITH SEISMIC ZONE, RIGIDITY OF SUPPORT & ROOM USE)

WEIGHT OF BANK (MB) = 264 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF BANK (DM) = 3082 ft-lbs SEISMIC MOMENT (MB) (FT.LBS.)

WEIGHT OF REAR BRACE (WFRB) = 88 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF FRONT BRACE (DM) = 514 ft-lbs SEISMIC MOMENT (WFRB) (FT.LBS.)

WEIGHT OF MAST (WM) = 359 lbs X SEISMIC FACTOR X DISTANCE TO MIDPOINT OF MAST (DM) = 2253 ft-lbs SEISMIC MOMENT (WM) (FT.LBS.)

WM + WFB + WM = BACKSTOP'S TOTAL WEIGHT LOAD = 5848 ft-lbs SUM OF THE MOMENTS = MB + WFRB + WM

POINT REACTIONS FROM WEIGHT LOADS AND SEISMIC WITH BANK DOWN

REATIONS AT HINGE LINE AT POINT A FROM WEIGHT LOADS AND SEISMIC PARALLEL TO BANK (FIG. 2)

**BANK DOWN**

\[ R_{\text{h,AV}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF REAR BRACE} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF PULLEY} \pm \frac{\text{SUM OF THE MOMENTS}}{2 \text{ SUPPORTS}} \]

**BANK DOWN**

\[ R_{\text{h,AV}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF REAR BRACE} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \frac{\text{SUM OF THE MOMENTS}}{2 \text{ SUPPORTS}} \]

POINT REACTIONS FROM WEIGHT LOADS AND SEISMIC WITH BANK UP

HOST CABLE TENSION AT POINT B = 610 lbs = \( \frac{\text{SUM OF THE MOMENTS}}{\text{SEISMIC FACTOR X DISTANCE FROM A TO B}} \)

RECTIONS AT HINGE LINE AT POINT A FROM WEIGHT LOADS AND SEISMIC PARALLEL TO BANK (FIG. 2)

**BANK UP**

\[ R_{\text{h,AV}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF REAR BRACE} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \frac{\text{SUM OF THE MOMENTS}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF PULLEY} \]

**BANK UP**

\[ R_{\text{h,AV}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF REAR BRACE} \]

\[ R_{\text{h,HO}} = \frac{\text{WEIGHT LOAD AT POINT "A"}}{2 \text{ SUPPORTS}} + \frac{\text{SUM OF THE MOMENTS}}{2 \text{ SUPPORTS}} + \text{WEIGHT OF PULLEY} \]