

ALPHA DETAILERS

Project: FDNY EMS STATION 20
1400 PELHAM PARKWAY SOUTH

Beam Splice Calculations

Required Cap = 50% Design Capacity of Beam

W12X26 ϕM_n (AISC Table 3-10)	52 kip-ft
Length	20 ft
Req'd Splice = 50% Section Capacity	26 kip-ft
Req'd Splice Axial $\phi Mn /$ (Beam Depth)	25.57 kips
Assume Bending Load is Carried by Flange Plates	
Load to Flange	25.57 kips
Load to Top Flange Splice Plate (1/2 to Top)	12.79 kips
Load to Bot Flange Splice Plates (1/2 to Bot Small Plates)	12.79 kips
Load to Each Bot Splice Plate	6.39 kips

Beam	W12X26
Beam Depth d	12.2
Beam Flange bf	6.49
Beam Flange Thickness tf	0.38
Beam Web Thickness tw	0.23
Steel Beam Fu	65 ksi
Steel Beam Fy	50
Steel Plate Fy	36 ksi
Steel Plate Fu	58 ksi
T. Flange Plate Thickness	0.375 in
T. Plate Length	11.5 in
T. Plate Width	5.5 in
B. Flange Plate Thickness	0.375 in
B. Plate Length	11.5 in
B. Plate Width	2 in
Web Plate Thickness	0.375 in
Plate Length	11.5 in
Plate Width	5.5 in
GAGE - C/C Flange Transverse Spacing	2.625 in
A-325N Bolt Dia	3/4 in
ϕF_n (Bolt Strength)	36 ksi
Hole Dia	14/16 in
Bolt Area	0.442 in ²
Fnv Single Shear (Bolt Strength)	15.9 kips
Fnv Double Shear (Bolt Strength)	31.8 kips

A. Flange Connection

<u>Bolts</u>	
n-bolts	4
Axial Bolt Capacity Double Shear	127.21 kips
ϕMn	129.33 kip-ft
	25.57 OK

Net Section

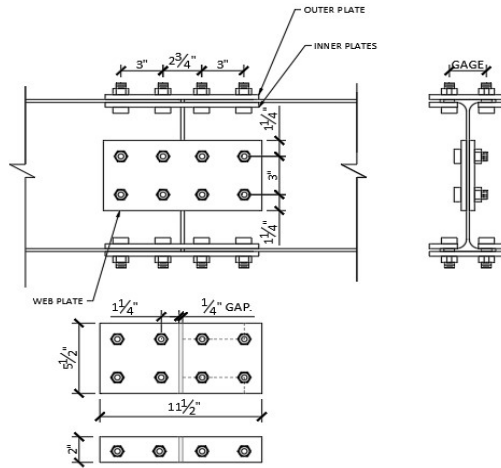
Ag	4.16 in ²
Anet	2.43 kip-ft
ϕRn	118.34 kips
ϕMn	120.31 kip-ft
	25.57 OK

Blockshear Fracture

Anv	2.23 in ²
Ant	1.14 in ²
Agv	3.23 in ²
Agt	1.47 in ²
FuAnt	73.85 kips
.6 Fy Agv	96.90 kips
.6 Fu Anv	87.07 kips
Ubs (Uniform Stress)	1.00
ϕRbs	120.69 kips
ϕMn	122.70 kip-ft
	25.57 OK

ASSUMPTIONS

- LOAD PATH ASSUMED FROM BEAM TO BOLTS TO SPLICE PLATE TO NEXT SET OF BOLTS TO BEAM
- FLANGE SPLICE PLATE TO CARRY BENDING MOMENT AS AXIAL FORCE
- WEB PLATE TO CARRY SHEAR FORCES FROM LOAD



CHECK BOLTS CAPACITY IN DOUBLE SHEAR ASSUME 4 BOLTS

CHECK NET SECTIONS REDUCED CAPACITY DUE TO HOLES (AISC J4-1)

CHECK BLOCK SHEAR FAILURE SECTION (AISC J4-5)

$$\phi (.6 Fu Anv + Ubs Fu Ant) \leq \phi (.6 Fy Agv + Ubs Fu Ant)$$

B. Flange Plates

<u>Outer Plate</u>	
Agt	2.06
Ant	1.41
.85 Agt	1.75
ϕRnt	61.17 kips
ϕRgt	66.83 kips
	12.79 OK

TRY 11 1/2 x 5 1/2 x 3/8 PLATE TOP PLATE
TRY 11 1/2 x 2 x 3/8 PLATE BOT PLATE (AISC J4-2)

Block Shear Fracture

Anv	2.70
Ant	2.00
Agv	3.19
Agt	2.88
Fu Ant	116.00 kips
.6 Fy Agv	68.85 kips

BLOCK SHEAR FRACTURE ON TOP PLATE (AISC J4-5)

.6 Fu Anv	93.80 kips		
Ubs (Uniform Stress)	1.00		
ϕR_{bs}	138.64 kips	12.79 OK	$\phi (.6 Fu Anv + Ubs Fu Ant) \leq \phi (.6 Fy Agv + Ubs Fu Ant)$
ϕM_n	140.95 kip-ft		
<u>Bearing</u>			
ϕR_p	117.5 kips	12.79 OK	FLANGE LOAD BEARING ON TOP PLATE (AISC J3-6A) $1.2 L_c t Fu \leq 2.4 d t Fu$
<u>Each Inner Plate</u>			
Ag _t	0.75		FLANGE LOAD BEARING ON EACH SMALLER PLATE
Ant	0.42		
.85 Ag _t	0.64		
ϕR_{nt}	18.35 kips	6.39 OK	
ϕR_{gt}	24.30 kips	6.39 OK	
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<u>C. Bearing / Tearout</u>			
<u>Bearing on Beam Flange</u>			
ϕr_p	33.35 kips		BOLTS AND PLATES ARE SUFFICIENT CHECK BEARING AND TEAROUT FOR WHOLE CONNECTION (AISC J3-6A) $\phi 1.2 L_c t Fu \leq \phi 2.4 d t Fu$
<u>Bearing on Outer Plate</u>			
ϕr_p	29.36 kips		
<u>Bearing on Inner Plate</u>			
ϕr_p	29.36 kips		
<u>Tearout on Beam Flange</u>			
L _c	0.875		
ϕr_{to}	19.45 kips		
<u>Tearout on Outer Plate</u>			
L _c	0.875		
ϕr_{to}	17.13 kips		
<u>Tearout on Inner Plates</u>			
L _c	0.875		LC MIN - TEAROUT BETWEEN BOLTS (3" SPACING) WILL NOT CONTROL
ϕr_{to}	17.13 kips		
<u>Edge Bolt Capacity Each Flange</u>			
	15.90 kips		GOVERNING CAPACITY FOR EDGE BOLT - TEAROUT BEAM FLANGE
<u>Central Bolt Capacity Each Flange</u>			
	15.90 kips		GOVERNING CAPACITY FOR CENTRAL BOLT - SINGLE SHEAR
ϕR_{vpt}	127.21 kips	25.57 OK	CAPACITY OF CONNECTION OF ALL LIMITING STATES FOR ALL BOLTS
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<u>D. Web Connection (Assume Beam Web Carries Vert. Shear)</u>			
<u>Bolts</u>			
n-bolts	8		
Axial Bolt Capacity Double Shear	254.42 kips	25.57 OK	
<u>Web Capacity</u>			
ϕV_n	75.762 kips	25.57 OK	(AISC G2-1)