

STRUCTURAL CALCULATIONS

Anchorage of Dental Equipment to Interior Wall: *Oak Board over Metal Studs*

Prepared for: Henry Schein Dental

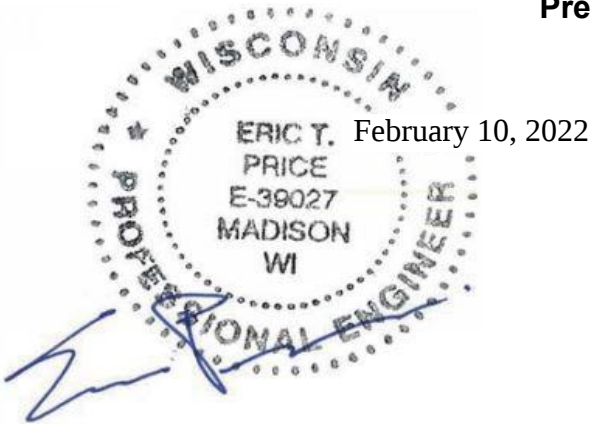


TABLE OF CONTENTS

- Lag Screw Analysis
- Installation Detail
- Supporting Documentation

SUMMARY OF RESULTS

- Use (6) #10x3" Simpson Strong-Tie Self-Drilling Bugle-Head Screws (or approved equal) per metal stud (24 screws total) to properly anchor the 2x10 oak board to the wall. Specific Simpson Strong-Tie screw model number = F10T300BD.
- To adequately secure the KAVO Orthopantomograph OP 3D unit to wall, use (2) 3/8" diameter x 1-1/2" long lag screws anchored into the oak board.
- To adequately secure the Planmeca Viso unit to wall, use (4) 3/8" diameter x 1-1/2" long lag screws anchored into the oak board.
- Refer to attached Backing Installation Detail for additional information.

LAG SCREW ANALYSIS

Client: Henry Schein Dental

Project Description: Bracket Anchorage to Oak Board (OP 3D unit)

Designed By: ETP

Date: 2/7/2022



LAG SCREW WITHDRAWAL ANALYSIS

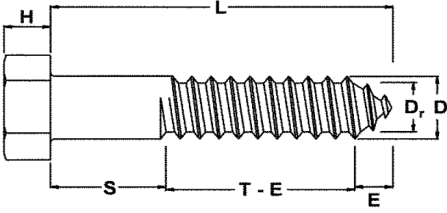
Analyzed in Accordance with the 2018 NDS Design Specifications (ASD & LRFD)

LOADING INFORMATION:

Withdrawal Load (ASD), $P =$ 340 lbs. per OP 3D manual (p8)
Factored Withdrawal Load (LRFD), $P =$ $= 340 \times 1.4$ 476 lbs. Factored as noted
Load Duration Factor, C_D (ASD) = Dead Load 0.90 Table 2.3.2
Time Effect Factor, λ (LRFD) = 1.4D 0.60 Appendix N; N.3.3

LAG SCREW INFORMATION:

Lag Screw Diameter, $D =$ 3/8"
Selected Length, $L =$ 1-1/2"
Root Diameter, $D_r =$ 0.265 in. Appendix A; Table L2
Overall Thread Length, $T =$ 1.250 in. Appendix A; Table L2
Unthreaded Length, $S =$ 0.250 in. Appendix A; Table L2
Tapered Tip Length, $E =$ 0.219 in. Appendix A; Table L2
Maximum Effective Thread Length $= L - S - E =$ 1.031 in.
Standard Washer Thickness $=$ 0.083 in.
No. of Lag Screws Provided $=$ override



MEMBER GEOMETRY:

Side Member/Sheathing Thickness $=$ 0.250 in. thickness of bracket
Actual Thread Length Embedment Into Member, $p_t =$ 0.948 in. Embedment into oak board
Specific Gravity of Member, $G =$ Average SG for Oak 0.67 Table 12.3.3A

ANALYSIS:

Unadjusted Withdrawal Value, $W = 1800 G^{3/2} D^{3/4} =$ 473 lbs/in. (12.2-1)

Adjusted Withdrawal Values:

For ASD: $W' = W C_D =$ 426 lbs/in.

For LRFD: $W' = W 3.32 0.65 \lambda =$ 613 lbs/in.

No. Lag Screws Req'd:

ASD $= P_{ASD} / (p_t \times W'_{ASD}) =$ 0.8 lags

LRFD $= P_{LRFD} / (p_t \times W'_{LRFD}) =$ 0.8 lags

Check:

OK

OK

RESULTS:

Use (2) 3/8" dia. x 1-1/2" lag screws to properly secure the OP 3D bracket to oak board.

Client: Henry Schein Dental

Project Description: Bracket Anchorage to Oak Board (Viso unit)

Designed By: ETP

Date: 2/7/2022



LAG SCREW WITHDRAWAL ANALYSIS

Analyzed in Accordance with the 2018 NDS Design Specifications (ASD & LRFD)

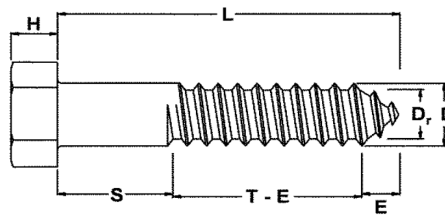
LOADING INFORMATION:

Withdrawal Load (ASD), $P = 1,400$ lbs. *per Viso manual (p18)*
Factored Withdrawal Load (LRFD), $P = 1,960$ lbs. *Factored as noted*

Load Duration Factor, C_D (ASD) = *Dead Load* 0.90 *Table 2.3.2*
Time Effect Factor, λ (LRFD) = *1.4D* 0.60 *Appendix N; N.3.3*

LAG SCREW INFORMATION:

Lag Screw Diameter, $D = 3/8"$
Selected Length, $L = 1-1/2"$
Root Diameter, $D_r = 0.265$ in. *Appendix A; Table L2*
Overall Thread Length, $T = 1.250$ in. *Appendix A; Table L2*
Unthreaded Length, $S = 0.250$ in. *Appendix A; Table L2*
Tapered Tip Length, $E = 0.219$ in. *Appendix A; Table L2*
Maximum Effective Thread Length = $L - S - E = 1.031$ in.
Standard Washer Thickness = 0.083 in.
No. of Lag Screws Provided = 4



MEMBER GEOMETRY:

Side Member/Sheathing Thickness = 0.250 in. *thickness of bracket*
Actual Thread Length Embedment Into Member, $p_t = 0.948$ in. *Embedment into oak board*
Specific Gravity of Member, $G = 0.67$ *Average SG for Oak Table 12.3.3A*

ANALYSIS:

Unadjusted Withdrawal Value, $W = 1800 G^{3/2} D^{3/4} = 473$ lbs/in. *(12.2-1)*

Adjusted Withdrawal Values:

For ASD: $W' = W C_D = 426$ lbs/in.

For LRFD: $W' = W 3.32 0.65 \lambda = 613$ lbs/in.

No. Lag Screws Req'd:

ASD = $P_{ASD} / (p_t \times W'_{ASD}) = 3.5$ lags

LRFD = $P_{LRFD} / (p_t \times W'_{LRFD}) = 3.4$ lags

Check:

OK

OK

RESULTS:

Use (4) 3/8" dia. x 1-1/2" lag screws to properly secure the Viso bracket to oak board.

INSTALLATION DETAIL

FOLLOW LOCAL CODES FOR ALL WORK.

DETAIL PROVIDED FOR BLOCKING & UTILITY REQUIREMENTS. REFER TO MANUFACTURER'S INSTALLATION GUIDE FOR ADDITIONAL INFORMATION.

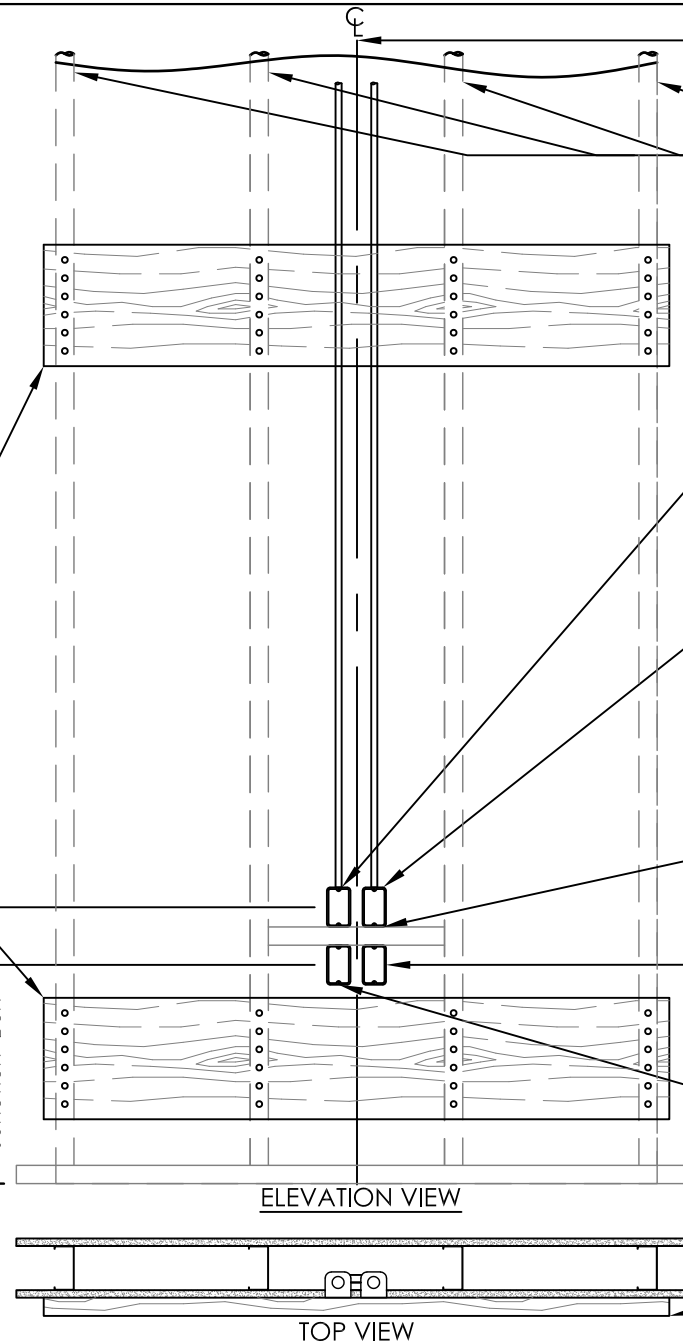
MOUNTING MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR.

2X10 OAK BOARDS ANCHORED TO WALL USING (6) SIMPSON STRONG-TIE F10T300BD #10X3" BUGLE HEAD SELF-DRILLING SCREWS PER STUD (24 SCREWS TOTAL). INSTALL SCREWS FLUSH WITH FACE OF BOARD. BOARD TO EXTEND 1" BEYOND OUTERMOST STUDS. CONFIRM HEIGHT PER MANUFACTURER SPECIFICATIONS.

February 10, 2022

ERIC T.
PRICE
E-39027
MADISON
WI

NOT TO SCALE



CENTERLINE OF X-RAY COLUMN.
SEE SHEET SA.1 FOR LOCATION.

PROPERLY SECURE COLD FORMED
STEEL (CFS) METAL WALL FRAMING
TO STRUCTURE ABOVE FOLLOWING
LOCAL CODES

SINGLE-GANG JUNCTION BOX AND
1" CONDUIT TO ABOVE CEILING (OR
PER CODE) WITH PULL-STRING BY
ELECTRICIAN TO 9B LOCATION. SEE
SHEET SE.1.

SINGLE-GANG JUNCTION BOX AND
1" CONDUIT TO ABOVE CEILING (OR
PER CODE) BY ELECTRICIAN FOR
CONNECTION TO DEDICATED
COMPUTER OR SERVER. DATA
CABLING & RJ45 OUTLET BY
OWNER'S I.T. COMPANY.

CONFIRM HEIGHTS WILL NOT
CONFLICT WITH X-RAY BRACKET
HEIGHTS. SEE HENRY SCHEIN REP.

SINGLE-GANG JUNCTION BOX W/
230V SIMPLEX OUTLET ON DEDICATED
25A CIRCUIT BY ELECTRICIAN (VERIFY
WITH HENRY SCHEIN EQUIPMENT REP).

SINGLE-GANG JUNCTION BOX W/
115V SIMPLEX OUTLET ON DEDICATED
20A CIRCUIT BY ELECTRICIAN.

5/8" GYP. BRD. AT FINISH

2 X 10 OAK BOARD ON FRONT
FACE OF WALL

9C

PANORAMIC X-RAY - METAL STUD RETROFIT

SUPPORTING DOCUMENTATION

Calculated withdrawal/pull-out capacity = 84 lbs/screw (Factor of Safety = 3.0)

Total withdrawal capacity of oak board from wall = (6 screws/stud) x 4 studs x 84 lbs/screw = **2,016 lbs** (allowable capacity).
[ultimate capacity = 2,016 x 3.0 = 6,048 lbs]

Fastening Options

Conservatively assume lightest gauge steel studs

Connections can be made using a variety of fastening options. It is critical to specify the proper fastener to ensure the proper performance of the connections in cold-formed steel construction. The most common and widely used connection methods are screw connections and weld connections. Each type of connection method has various advantages and disadvantages. Therefore, we provide data for both types so you can choose your preferred connection method.



Self-Drilling Screws—externally threaded fasteners with the ability to drill their own hole and form, or “tap,” their own internal threads without deforming their thread and without breaking during installation. These screws are high-strength, one-piece fasteners and are used if the connection of multiple thicknesses of 33mil steel or thicker. One of the more

common self-drilling screws is a #10-16 x 5/8 HWH SD, which indicates a #10 diameter shaft, 16 threads per inch, 5/8 length, hex washer head self-drilling screw.

Fillet Welds—used to make lap joints, corner joints and T-joint connections. As the illustration suggests, the fillet weld is roughly triangular in cross-section, although its shape is not always a right triangle or an isosceles triangle. Weld metal is deposited in a corner formed by the fit-up of the two members and penetrates and fuses with the base metal to form the joint.

Flare Welds—used to join rounded or curved pieces.

- A Flare Bevel groove weld is commonly used to join a rounded or curved piece to a flat piece.
- A Flare V groove weld is commonly used to join two rounded or curved parts.

ALLOWABLE SCREW DESIGN VALUES (LBS/SCREW)

Mils (Gauge)	Design thickness (in)	F _y (ksi)	F _u (ksi)	#8 Screw			#10 Screw			#12 Screw			1/4" Screw		
				0.164" Dia, 0.272" Head			0.190" Dia, 0.340" Head			0.216" Dia, 0.340" Head			0.250" Dia, 0.409" Head		
				Pss = 1000 lbs; Pts = 1545 lbs			Pss = 1400 lbs; Pts = 1936 lbs			Pss = 2000 lbs; Pts = 2778 lbs			Pss = 2600 lbs; Pts = 4060 lbs		
				Shear	Pull-Over	Pull-Out	Shear	Pull-Over	Pull-Out	Shear	Pull-Over	Pull-Out	Shear	Pull-Over	Pull-Out
33 (20g)	0.0346	33	45	164	212	72	177	265	84	188	265	95	203	318	110
43 (18g)	0.0451	33	45	244	276	94	263	343	109	280	345	124	302	415	144
54 (16g)	0.0566	33	45	333	346	118	370	433	137	394	433	156	424	521	180
		50	65	333	500	171	467	625	198	569	625	225	613	752	261
68 (14g)	0.0713	33	45	333	436	149	467	545	173	557	545	196	600	656	227
		50	65	333	515	215	467	645	249	667	788	284	866	948	328
97 (12g)	0.1017	33	45	333	515	213	467	645	246	667	778	280	867	936	324
		50	65	333	515	307	467	645	356	667	926	405	867	1352	468
118 (10g)	0.1242	33	45	333	515	260	467	645	301	667	926	342	867	1143	396
		50	65	333	515	375	467	645	435	667	926	494	867	1353	572

Screw Value Notes:

- 1 Capacities are based on Section J4 of the NASPEC AISI S100-16 Calculations.
- 2 When connecting materials of different steel thickness or tensile strengths, use the lowest values. Tabulated capacities assume two sheets of equal thickness are connected.
- 3 Calculated capacities are based on Allowable Strength Design (ASD) and include appropriate safety factors.
- 4 When multiple fasteners are used, screws are assumed to have a center-to-center spacing of at least 3 times the nominal diameter.
- 5 Screws are assumed to have a center-of-screw to edge-of-steel dimension of at least 1.5 times the nominal diameter of the screw.
- 6 Pullout capacity is based on the lesser of pull-out capacity in sheet closest to screw tip or tension strength of screw.
- 7 Pullover capacity is based on the lesser of pullover capacity for sheet closest to screw header, or tension strength of screw.
- 8 Listed capacities are for pure shear or tension loads only. For combined shear and pullover, see AISI Section J4.5.
- 9 Shear strength for #8, #10, #12, and 1/4" screws shall be greater than or equal to 1000 lbs, 1400 lbs, 2000 lbs, and 2600 lbs respectively.
- 10 Tension strength for #8, #10, #12, and 1/4" screws shall be greater than or equal to 1545 lbs, 1936 lbs, 2778 lbs, and 4060 lbs respectively.

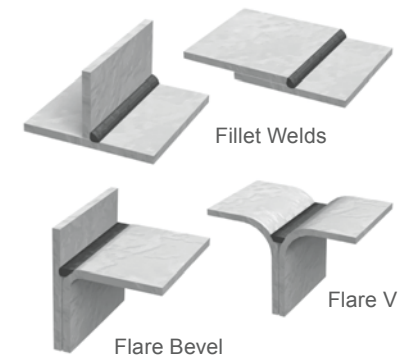
Shear and Pull-Over loading conditions not applicable.

ALLOWABLE WELD VALUES (LBS/IN)

Mils (Gauge)	Design thickness (in)	F _y (ksi)	F _u (ksi)	Weld (1 inch)	
				Fillet	Flare Groove
43 (18)	0.0451	33	45	619	544
		33	45	822	682
54 (16)	0.0566	50	65	1188	985
		33	45	1082	859
68 (14)	0.0713	50	65	1563	1241
		33	45	1269	1226
97 (12)	0.1017	50	65	1269	1402
		33	45	1550	1497
118 (10)	0.1242	50	65	1550	1712

Weld Value Notes:

- 1 Capacities are based on Sections J2.5, and J2.6 of the NASPEC AISI S100-16 Calculations.
- 2 When connecting materials of different steel thickness or tensile strengths, use the lowest values. Tabulated capacities assume two sheets of equal thickness are connected.
- 3 Calculated capacities are based on Allowable Strength Design (ASD) and include appropriate safety factors.
- 4 Weld strengths are given in lbs/in and are based on E60XX electrodes.
- 5 For flare groove welds when t > 0.1", tw = (5/16)*R when weld filled flush to surface.



Complies with AISI S100-16 • IBC 2018

Metal Screws

Self-Drilling Bugle-Head Screw

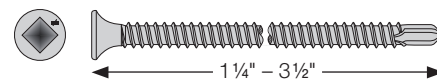
Common Application:

Fasten wood, plywood and OSB panels to steel studs

Features:

- Bugle heads drive flush with work surface.
- #2 square drive (replacement bit BIT2S-2).
- Tapping screw threads.
- #3 drill point.
- Type 410 stainless steel is coated for additional corrosion protection.
- Type 410 stainless steel can be hardened through heat treatment, giving it the ability to drill through metal. It does not offer the same level of corrosion resistance of either Type 316 or 305 stainless steel.
- **Warning:** Hardened stainless-steel fasteners should not be used with steel framing in environments with high humidity, condensation or other moisture that will be present at the dissimilar-metal interface.

For more information on drilling thickness capacities and drill speed recommendations, see pp. 26–27.



Type 410 Stainless Steel*

Size	Length (in.)	Threads Per Inch	Head Diameter (in.)	Carton Quantity	Model No.
#6	1 1/4	20	0.34	100	F06T125BDC
#6	1 1/4	20	0.34	1,000	F06T125BDM
#6	1 1/4	20	0.34	5,000	F06T125BDB
#8	1 5/8	18	0.34	100	F08T162BDC
#8	1 5/8	18	0.34	1,000	F08T162BDM
#8	1 5/8	18	0.34	3,000	F08T162BDB
#8	2	18	0.34	100	F08T200BDC
#8	2	18	0.34	1,000	F08T200BDM
#8	2	18	0.34	2,500	F08T200BDB
#10	2 1/2	16	0.34	100	F10T250BDC
#10	2 1/2	16	0.34	1,000	F10T250BDM
#10	2 1/2	16	0.34	2,000	F10T250BDB
#10	3	16	0.34	100	F10T300BDC
#10	3	16	0.34	1,500	F10T300BDB
#10	3 1/2	16	0.34	100	F10T350BDC
#10	3 1/2	16	0.34	1,000	F10T350BDB

* These products are subject to quantities on hand or may require special ordering and are subject to minimum order quantities and longer lead times. Call Simpson Strong-Tie for details (800) 999-5099.

- Ensure the proper tightness and attachment of all of the screws and bolts when installing the device.
- All device covers must be properly installed before handing the device to the user.
- Ensure the electrical safety of the device by inspecting the proper grounding of user touchable metallic parts before handing the device to the user.

1500 newtons (N)
= 337.2 lbs

2.5.2 Device installation requirements

2.5.2.1 Installation location requirements

WARNING! Ensure that each of the wall mount fixing screws and the wall can withstand pull-out force of at least 1500 N.

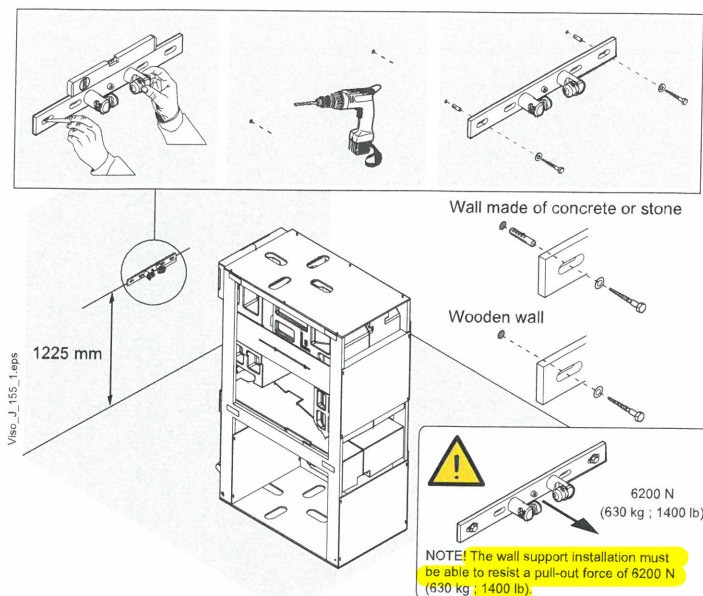
- The place where the device is to be installed and the position from where the user takes images must be correctly shielded from the radiation that is generated when the device is operated. Follow the local radiation and safety requirements.
- The device must be fixed to the wall and the floor.

NOTICE! If the device cannot be fixed to the floor, install the device to an exhibition stand. See chapter [Exhibition stand installation](#) on page 108 for instructions.

- The wall material should be suitable for fixing the device. If the wall is made of a weak material, you may have to use a reinforcing plate on the rear side of the wall to hold the fixing hardware.
- Make sure that the floor, where the device is to be installed, can support its weight. To avoid the device from tipping over, fix the device with floor bolts appropriate to the floor material. The floor bolts and the floor material must withstand pull-out force of at least 1500 N.
- The device must be installed on a hard floor surface. All soft and elastic material, such as a carpet, must be removed from under the column floor plate.
- Do not install the device in environments where corrosive or explosive vapours or flammable anaesthetics are present.
- Special steps regarding EMC need to be taken when installing the device. For more information, refer to the chapter [Electromagnetic Compatibility \(EMC\) tables](#) on page 149.
- The device is supplied with a 3 m (10 ft) long power cord. Ensure that the connected power cord and Ethernet cables are long enough, as they need to move along with the device's up/down movements.

NOTICE! It's recommended to route the power feed and Ethernet connection to behind the device to ensure unobstructed movement of the cables.

- It's recommended to use a max. 30 A circuit breaker with the device.
- Maximum allowed mains line impedance is 0.2 Ω.
- For permanent installation, a separate lockable mains switch (not supplied) is required to be installed to the mains feed.
- Recommended mains over-current releases:
 - 100-120 V: 16 A
 - 220-240 V: 10 A



1.b. Drill the holes to the wall.

Note the following requirements.

- If the wall is made of concrete or brick, use the M10x70 DIN 571 screws and the 14x70 expansion anchors to secure the wall bracket in position. Drill securing holes $\varnothing 14$ mm (0.55 in.), 85 mm (3.3 in.) in depth, and insert the expansion anchors into the holes.
- If the wall is made of wood, use the M10x70 DIN 571 screws. Do not use expansion anchors with wooden wall. Drill securing holes $\varnothing 7$ mm (0.3 in.), 70-75 mm (2.75-3 in.) in depth, for the mounting screws.

NOTE

Use four mounting screws (instead of two) if you use smaller anchors and/or screws than recommended.

CAUTION

The wall support installation must be able to resist a pull-out force of 6200 N (630 kg; 1400 lb).

1.c. Attach the wall support and tighten the screws firmly.