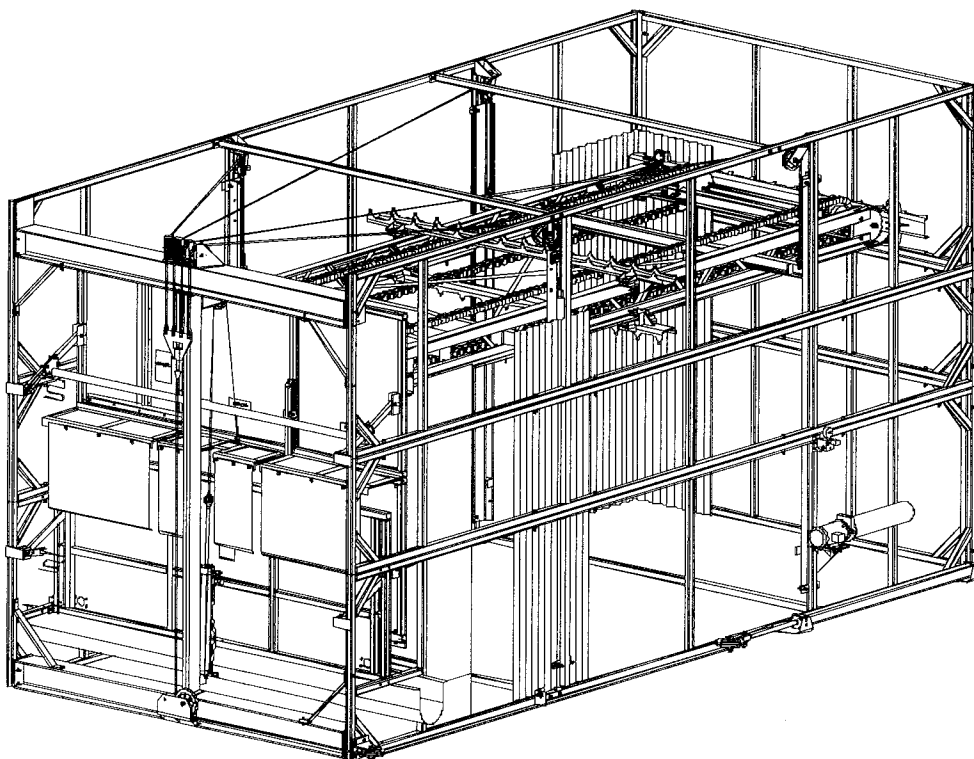


TURBO[®]

REFRIGERATING

CB Series Rake Manual Installation, Operation & Maintenance



Unit Model Number _____

Unit Serial Number _____

Assembly Drawing Number _____

Bin Door Drawing Number _____

Hydraulic Schematic Drawing Number _____

Wiring Schematic Drawing Number _____

Ladder Logic File Number _____



CB Series Rake Manual Installation, Operation & Maintenance

Table of Contents

| | | |
|------------------|--|-------------|
| Section 1 | Introduction..... | 1- 1 |
| | History..... | 1- 1 |
| | USDA..... | 1- 1 |
| | Operation..... | 1- 2 |
| | Loading the Ice Storage Bin..... | 1- 2 |
| | Unloading the Ice Storage Bin..... | 1- 2 |
| | Rake Variations..... | 1- 3 |
| | Controls..... | 1- 4 |
| | Sanitary Ice..... | 1- 4 |
| | Ice Delivery..... | 1- 4 |
| | Optional Rake Features..... | 1- 5 |
| | Optional Features..... | 1- 5 |
| | Associated Equipment..... | 1- 5 |
| | TURBO ® TIG/TIGAR Ice Generators..... | 1- 5 |
| | Typical Applications..... | 1- 5 |
| | Special Applications..... | 1- 6 |
| | Customer Service..... | 1- 6 |
| | Typical Rake Assembly..... | 1- 7 |
| Section 2 | Safety..... | 2- 1 |
| | Safety Definitions..... | 2- 1 |
| | Warning..... | 2- 1 |
| | Caution..... | 2- 1 |
| | Important..... | 2- 1 |
| | Note..... | 2- 1 |
| | Machinery is Dangerous..... | 2- 1 |
| | WARNINGS..... | 2- 2 |
| | Involve your People..... | 2- 4 |
| | Emergency Stop Button..... | 2- 5 |
| | Master control Switch..... | 2- 5 |
| | Retaining Wall | 2- 5 |
| | Stored Energy..... | 2- 6 |
| | Conveyor Manufacturer's Instructions and Warnings..... | 2- 6 |
| | Safety Lock Out Procedure..... | 2- 8 |

| | |
|---|--------------|
| Purpose | 2- 8 |
| Scope | 2- 8 |
| Supervisory Responsibility..... | 2- 8 |
| Safety Locks..... | 2- 8 |
| Safety Department Responsibility..... | 2- 9 |
| Rules and Regulations..... | 2- 9 |
| Outside Contractors..... | 2- 10 |
| Failure to Follow Procedures..... | 2- 10 |
| Section 3 | |
| Installation and Assembly Requirements..... | 3- 1 |
| Assembly Sequence – 18 Step Guide to Installation..... | 3- 1 |
| Site Preparation..... | 3- 2 |
| Packing Slip..... | 3- 2 |
| To Help Get You Started..... | 3- 3 |
| Helpful Hints..... | 3- 3 |
| Tools | 3- 4 |
| General Requirements..... | 3- 4 |
| Refrigerated versus Non-Refrigerated Storage Bin..... | 3- 5 |
| Packaged Ice Applications..... | 3- 5 |
| Produce/Fish/Poultry Top Icing Application..... | 3- 6 |
| Air Circulation..... | 3- 7 |
| Drainage..... | 3- 8 |
| False Floors..... | 3- 8 |
| New Construction..... | 3- 9 |
| Existing Rakes/Structures..... | 3- 9 |
| Electrical..... | 3- 9 |
| Three-Phase..... | 3- 9 |
| Single-Phase..... | 3- 9 |
| Disconnects/Circuit Breaker Panels..... | 3- 10 |
| Underwriter's Laboratory (UL) Listing..... | 3- 10 |
| Lighting..... | 3- 10 |
| Access Doors to Storage Room..... | 3- 10 |
| Bin liner Material..... | 3- 10 |
| Above Floor Screw versus Recessed Floor Screw Conveyor..... | 3- 10 |
| Above floor Installation..... | 3- 10 |
| Recessed floor Screw Installation..... | 3- 11 |
| General Specifications..... | 3- 11 |
| Minimum Recommended Clearance..... | 3- 12 |
| Ice Storage Capacities and Dimensions..... | 3- 12 |
| Ice Storage Capacity –Tons/Foot..... | 3- 13 |
| Delivery Inspection..... | 3- 14 |
| Delivery Inspection Checklist..... | 3- 14 |
| Loose Boxes and Crates..... | 3- 14 |
| Warning Labels..... | 3- 15 |

| | |
|---|--------------|
| Handling of Rake Components | 3- 15 |
| TURBO Nameplate..... | 3- 16 |
| Equipment..... | 3- 16 |
| Bin Structure Installation..... | 3- 17 |
| General Steel Erection Plan..... | 3- 17 |
| Horizontal Bin Braces..... | 3- 19 |
| Diagonal Cross Brace Installation..... | 3- 19 |
| Rake Pulley Installation..... | 3- 22 |
| Lifting Point Pulley Installation..... | 3- 22 |
| Rake Bin Liner Installation..... | 3- 24 |
| General Requirements..... | 3- 24 |
| Corrugated Liner Installation..... | 3- 24 |
| HDPE Liner Installation..... | 3- 26 |
| Lexan Panel Installation..... | 3- 26 |
| HDPE Liner CB-30..... | 3- 28 |
| HDPE Liner CB-31..... | 3- 28 |
| HDPE Liner CB-50..... | 3- 29 |
| HDPE Liner CB-59..... | 3- 30 |
| HDPE Liner CB-87..... | 3- 31 |
| Rake Guide Installation..... | 3- 32 |
| Location and Installation..... | 3- 32 |
| Rake Assembly | 3- 35 |
| Lifting Beam Installation..... | 3- 35 |
| Idler and Drive Assembly Installation..... | 3- 36 |
| Cross Bracing Rod Installation..... | 3- 37 |
| Sprocket Measurements..... | 3- 38 |
| Electrical Conduit Installation..... | 3- 39 |
| Rake Drive Wiring Assembly Installation..... | 3- 39 |
| Rake Stop Installation..... | 3- 40 |
| Rake Flite and Chain Installation..... | 3- 41 |
| Return Bend Adjustment..... | 3- 44 |
| Return Bend Adjustment Procedure..... | 3- 45 |
| Rake Drive Chain..... | 3- 46 |
| Rake Lift Assembly Installation..... | 3- 47 |
| Preferred Location of Hoist..... | 3- 47 |
| Alternate Hoist Locations..... | 3- 47 |
| Installation..... | 3- 47 |
| Rake Lift Cable Installation..... | 3- 48 |
| Rake Cable Clamp Attachment..... | 3- 48 |
| Installation of Rake Pulley – Upper I-Beam..... | 3- 49 |
| Lower Beam Center Pulley Installation..... | 3- 54 |
| Corner Pulley Bracket Installation..... | 3- 55 |

| | |
|--|--------------|
| Hydraulic Cylinder Installation..... | 3- 55 |
| Hydraulic Power Unit/Hydraulic Manifold Block Installation..... | 3- 56 |
| Mounting the Hydraulic Power Unit..... | 3- 56 |
| Mounting the Hydraulic Manifold Block..... | 3- 58 |
| Cable Assembly..... | 3- 61 |
| Single Acting Hydraulic Lift..... | 3- 61 |
| Double Acting Hydraulic Lift..... | 3- 62 |
| Single and Double Acting Hydraulic Lift..... | 3- 63 |
| Lift Cable to Yoke Installation..... | 3- 63 |
| Floor Screw Conveyor Trough Installation | 3- 65 |
| Above Floor Screw Conveyor..... | 3- 66 |
| Recessed Floor Screw..... | 3- 66 |
| Screw Conveyor Size..... | 3- 67 |
| Screw Conveyor Selection Factors..... | 3- 67 |
| Conveyor Speed..... | 3- 69 |
| Snow..... | 3- 70 |
| Conveyor Covers..... | 3- 70 |
| Space..... | 3- 70 |
| Conveyor Discharge..... | 3- 70 |
| Conveyor Material of Construction..... | 3- 70 |
| Rake Bin door Assembly and Installation..... | 3- 72 |
| General Requirements..... | 3- 72 |
| Alternate Installation Procedure..... | 3- 74 |
| Bin Door Weights..... | 3- 75 |
| Door Arm Stabilizer..... | 3- 76 |
| Door Limit Switch Installation – Hydraulic Door | 3- 77 |
| Bin Door Lifting Mechanism Installation..... | 3- 78 |
| A. Automatic Hydraulic Rake Bin Door Lifting Mechanism Installation/ Cable Assembly | |
| Installation..... | 3- 78 |
| General Requirements..... | 3- 78 |
| Hydraulic Cylinder Installation..... | 3- 79 |
| Door Limit Switch..... | 3- 80 |
| Retainer Wall and Safety Switch Installation..... | 3- 81 |
| Retaining Wall Installation..... | 3- 81 |
| Safety Cover Installation..... | 3- 82 |
| Proximity Safety Switch installation | 3- 82 |
| Electrical components Installation..... | 3- 84 |
| Electrical control panel..... | 3- 84 |
| Control Panel Installation..... | 3- 84 |
| Helpful Hints..... | 3- 85 |

| | |
|--|--------------|
| Pre-Start-Up Cleaning Procedure..... | 3- 86 |
| General Clean Up..... | 3- 86 |
| Rake Girder Clean Up..... | 3- 86 |
| Installation Review and Start-Up Checklist..... | 3- 87 |
| Review of Standard Component Installation..... | 3- 87 |

| | | |
|------------------|--|-------------|
| Section 4 | Operating Instructions..... | 4- 1 |
| | Control Panel Devices..... | 4- 1 |
| | Master Control Switch..... | 4- 2 |
| | OFF Position..... | 4- 2 |
| | ON Position..... | 4- 2 |
| | Emergency Stop Push Button (ES)..... | 4- 3 |
| | Rake Function Selector Switch..... | 4- 3 |
| | AUTO Position..... | 4- 3 |
| | OFF Position | 4- 4 |
| | DOWN Position – Manual Down..... | 4- 4 |
| | UP Position – Manual UP..... | 4- 5 |
| | Delivery Switch (DS)..... | 4- 5 |
| | OFF Position..... | 4- 5 |
| | ON Position | 4- 5 |
| | Floor Screw Purge Push Button..... | 4- 6 |
| | Retainer Wall Safety Switches (LS-1 & LS-2)..... | 4- 7 |
| | Time Delay Relays..... | 4- 7 |
| | Floor Screw Overload Time Delay (TD1)/TD1-1 | |
| | Contact..... | 4- 7 |
| | Flag Switch Limit Switch..... | 4- 8 |
| | Mechanical Switch – Prior to 2000..... | 4- 8 |
| | Proximity Switch – After 2000..... | 4- 8 |
| | Rake Reversal Time Delay (TD2)/TD2-1 Contact..... | 4- 8 |
| | Stutter Timer (STR) – Electromechanical Systems..... | 4- 9 |
| | Typical Sequence..... | 4- 9 |
| | Rake Timer (TM1) – Electromechanical Systems..... | 4- 10 |
| | Load Detector – Prior to June 2001..... | 4- 10 |
| | Installation..... | 4- 11 |
| | Load Detector Relays..... | 4- 11 |
| | Load Detector with Soft Start..... | 4- 13 |
| | Tips on Square D Load Detector Adjustment/Settings.. | 4- 15 |
| | Autogard..... | 4- 15 |
| | Installation and Settings..... | 4- 15 |
| | Soft Start..... | 4- 19 |
| | Furnas..... | 4- 19 |
| | Voltage / Time Ramp..... | 4- 19 |
| | Current Limit Ramp..... | 4- 19 |
| | Siemens..... | 4- 19 |

| | |
|--|--------------|
| Ramp Up Time..... | 4- 19 |
| Voltage Ramp..... | 4- 19 |
| Running Down Ramp Time..... | 4- 19 |
| Electromechanical Controls/Control Relays..... | 4- 21 |
| Auto Mode Relay (CR1) CR1-1,-3,-4 Contacts..... | 4- 21 |
| Delivery Relay (CR3) CR3-1,-2,-3,-5 Contacts..... | 4- 21 |
| Maximum Load Relay (CR4) CR4-1 Contact..... | 4- 21 |
| Minimum Load Relay (CR5) CR5-1 Contact..... | 4- 22 |
| Ice Delivery to Bin Signal (BBM-1) – Option..... | 4- 22 |
| Surge Bin Limit Switch –option..... | 4- 23 |
| Pilot Lights..... | 4- 23 |
| Icemaker Defrosting – Blue..... | 4- 24 |
| Rake Drive Failure – Red..... | 4- 24 |
| Safety Failure – Red..... | 4- 24 |
| Door Failure – Red..... | 4- 25 |
| Floor Screw Failure – Red..... | 4- 25 |
| Rake Delivering – Green..... | 4- 25 |
| Rake Bin Full – Green..... | 4- 25 |
| Rake Bin empty – Green..... | 4- 25 |
| Auto Mode – Green..... | 4- 25 |
| Hoist Up – Green..... | 4- 25 |
| Hoist Down – Green..... | 4- 25 |
| Motor Starters / Motor Starter Overload Contacts..... | 4- 26 |
| Rake Forward Drive – FD..... | 4- 26 |
| Rake Reverse Drive – RD..... | 4- 26 |
| Hydraulic Pump Motor – P..... | 4- 27 |
| Floor Screw Conveyor Motor Starter – FS..... | 4- 27 |
| Mechanical Interlocks..... | 4- 27 |
| Forward Drive Interlock – FD-1..... | 4- 27 |
| Reverse Drive Interlock – RD-1..... | 4- 27 |
| Hydraulic Pump Motor Starter – P (Hydraulic Door) | 4- 27 |
| Floor Screw Conveyor Motor Starter – FS..... | 4- 27 |
| Magnetic Starter Mechanical Interlocks..... | 4- 28 |
| Forward Drive Interlock – FD-1..... | 4- 28 |
| Reverse Drive Interlock – RD-1..... | 4- 28 |
| Hydraulic Pump Motor Interlock – P-1)..... | 4- 28 |
| Floor Screw Conveyor Drive Interlock – FS-1..... | 4- 29 |
| Floor Screw Conveyor Drive Interlock – FS-2..... | 4- 29 |
| Delivery Screw Conveyor Interlock – DS-1..... | 4- 29 |
| Transfer or Roof Screw Conveyor Drive Interlock – RS-1..... | 4- 29 |

| | | |
|--|----|----|
| Starter Overload Relays..... | 4- | 29 |
| Rake Forward Starter Overload – FD-OL..... | 4- | 29 |
| Rake Reverse Starter Overload – RD-OL..... | 4- | 29 |
| Hydraulic Pump Overload – P-OL..... | 4- | 29 |
| Floor Screw Starter Overload – FS-OL..... | 4- | 29 |
| Overload Reset | 4- | 30 |
| Other Components..... | 4- | 30 |
| Hoist Down Solenoid (HDS) – Hydraulic Door | 4- | 30 |
| Circuit Protection – Control Circuit..... | 4- | 30 |
| Programmable Logic Controller (PLC) Control Panel Devices | 4- | 30 |
| Optional PLC Control Devices..... | 4- | 31 |
| Remote Emergency Stop Relay contact (R-1)..... | 4- | 31 |
| Enclosure Heater (EH)/enclosure Heater Thermostat (TS)..... | 4- | 32 |
| Door Open Limit Switch – DOLS..... | 4- | 33 |
| Door Closed Limit Switch – DCLS..... | 4- | 33 |
| Hoist Up Limit Switch – HULS..... | 4- | 34 |
| Hoist Down Limit Switch – HDLS..... | 4- | 34 |
| Optional Rake Flite Limit Switch – RFLS..... | 4- | 35 |
| Safety Failure Relay Contact - SFR-1 | 4- | 35 |
| Optional PLC Pilot Lights..... | 4- | 35 |
| Open Door – Green..... | 4- | 35 |
| Close Door – Green..... | 4- | 35 |
| Hydraulic Pump Failure – Red (Hydraulic Door)..... | 4- | 36 |
| Magnetic Starters – Optional Motors..... | 4- | 36 |
| Optional Screw Conveyor - DS..... | 4- | 36 |
| Optional Screw Conveyor Interlock – DS-1..... | 4- | 36 |
| Magnetic Starter Overloads..... | 4- | 36 |
| Rake Forward – FD-OL..... | 4- | 36 |
| Rake Reverse – RD-OL..... | 4- | 36 |
| Hydraulic Pump – P-OL (Hydraulic Door)..... | 4- | 36 |
| Floor Screw – FS-OL..... | 4- | 36 |
| Delivery Screw – DS-OL..... | 4- | 36 |
| Overload Reset Button..... | 4- | 36 |
| Operating Sequence: Electromechanical Controls without Load Detector..... | 4- | 38 |
| Selector Switch..... | 4- | 38 |
| OFF Position – Rake Not in Use..... | 4- | 38 |
| Quick Checklist when Rake in OFF Position..... | 4- | 38 |

| | | |
|------------------|---|--------------|
| | LOAD Position – Ice Delivery to Bin..... | 4- 38 |
| | Quick Checklist when Rake in Load Position..... | 4- 39 |
| | Alternate Hoist Controls..... | 4- 39 |
| | UNLOAD Position – Ice Removal from Bin..... | 4- 39 |
| | Operating Hints..... | 4- 41 |
| | Operating Sequence: Load Detector & Four Position Selector Switch..... | 4- 42 |
| | AUTO Position..... | 4- 42 |
| | Quick Checklist when Rake in AUTO Position..... | 4- 42 |
| | Loading Sequence..... | 4- 42 |
| | Unloading Sequence..... | 4- 42 |
| | Automatic Bin Door Operation..... | 4- 43 |
| | General Operating Sequence..... | 4- 43 |
| | Typical Door Closed Conditions..... | 4- 44 |
| | Typical Door Open Conditions..... | 4- 44 |
| | Typical Door Operation..... | 4- 44 |
| | Door Open Sequence..... | 4- 44 |
| | Door Close Sequence..... | 4- 45 |
| Section 5 | Trouble-Shooting..... | 5- 1 |
| | Problems and Solutions..... | 5- 1 |
| Section 6 | Maintenance..... | 6- 1 |
| | Daily Inspections..... | 6- 1 |
| | After Initial Ten hours of Operation..... | 6- 2 |
| | After Initial Fifty hours of Operation..... | 6- 2 |
| | Weekly Inspections..... | 6- 2 |
| | Every Two Weeks..... | 6- 2 |
| | Every Six Weeks..... | 6- 2 |
| | Timer Settings..... | 6- 3 |
| | PLC Counters & Timer Presets..... | 6- 3 |
| | Lubricants and Lubrication Schedule..... | 6- 4 |
| | Sample Daily Plant Log Sheet..... | 6- 5 |
| | Weekly Inspection Sheets..... | 6- 4 |
| | General Inspection sheet..... | 6- 4 |



CB Series Rake Manual Installation, Operation & Maintenance

Figures & Tables

| | | |
|------------------|--|------------|
| Section 1 | Introduction..... | 1-1 |
| | Table 1-1 Rake Variation & Capacities..... | 1-3 |
| Section 2 | Safety..... | 2-1 |
| | Figure 2-1 Warning Labels on Control Panel..... | 2-2 |
| | Figure 2-2 Warning Labels on Rake Bin Door & Retaining Wall..... | 2-3 |
| | Figure 2-3 Warning Labels on Access Door..... | 2-3 |
| | Figure 2-4 Good Visibility of Rake Bin Interior..... | 2-4 |
| Section 3 | Installation and Assembly Requirements..... | 3-1 |
| | Figure 3-1 Typical Packing Slip..... | 3-2 |
| | Figure 3-2 Rake Bin Orientation..... | 3-3 |
| | Table 3-1 Full Load Amps..... | 3-8 |
| | Table 3-2 Minimum Recommended Control Panel Clearance..... | 3-12 |
| | Table 3-3 Ice Storage Capacity per Foot of Standard Rake Models..... | 3-12 |
| | Table 3-5 Ice Storage Capacity for Standard Rake Models..... | 3-13 |
| | Table 3-7 Summary of Estimated Weights for CB Rake & Structure... | 3-16 |
| | Figure 3-3 Upper & Lower I-Beam Installation..... | 3-17 |
| | Figure 3-4 Typical Steel Structure..... | 3-18 |
| | Figure 3-5 Horizontal Bin Brace Installation..... | 3-19 |
| | Figure 3-6 Corner Diagonal Brace Installation..... | 3-20 |
| | Figure 3-7 Typical Section of Bolted Structures..... | 3-20 |
| | Figure 3-8 Typical Bolted Structures..... | 3-21 |
| | Figure 3-9 Rake Pulley Arrangement..... | 3-22 |
| | Figure 3-10 Typical Rake Pulley..... | 3-23 |
| | Figure 3-11 Corrugated Sheet Metal Installation – Bin Liner..... | 3-25 |
| | Figure 3-12 HDPE Liner Installation..... | 3-26 |
| | Figure 3-13 Lexan Panel Installation. | 3-27 |
| | Figure 3-14A CB-30 and 31 HDPE Liner Orientation..... | 3-28 |
| | Figure 3-14B CB-50 HDPE Liner Orientation | 3-29 |
| | Figure 3-14C CB-59 HDPE Liner Orientation | 3-30 |
| | Figure 3-14D CB-87 HDPE Liner Orientation | 3-31 |
| | Figure 3-15 Rake Guide / Rake Stop Installation..... | 3-32 |
| | Figure 3-16 Typical Upper Rake Guide Mounting Tabs..... | 3-33 |

| | |
|---|------|
| Figure 3-17 Typical Lower Rake Guide Mounting Tabs..... | 3-34 |
| Figure 3-18 Lifting Beam Installation..... | 3-35 |
| Figure 3-19 Drive and Idler End Installation..... | 3-36 |
| Figure 3-20 Cross Bracing Rods Installation..... | 3-37 |
| Figure 3-21 Sprocket Measurement..... | 3-38 |
| Figure 3-22 Rake Drive Wiring Assembly..... | 3-39 |
| Figure 3-23 Rake Flite Arrangement..... | 3-42 |
| Figure 3-24 Plastic Chain Attachment..... | 3-43 |
| Figure 3-25 Rake Flite K-1 Attachment-Steel Chain..... | 3-43 |
| Figure 3-26 Rake Flite Spacing..... | 3-44 |
| Figure 3-27 Return Bend Detail..... | 3-45 |
| Figure 3-28 Rake Flite Chain Adjustment..... | 3-46 |
| Figure 3-29 Typical CB Rake Assembly..... | 3-46 |
| Figure 3-30 Cable / Cable Clamp Installation..... | 3-48 |
| Figure 3-33 Typical Pulley Bracket..... | 3-51 |
| Table 3-8 Wire Rope Cable Clamp Specifications | 3-49 |
| Figure 3-31 Top Beam Pulley Assembly..... | 3-49 |
| Figure 3-32 Rake Lift Pulley Assembly..... | 3-51 |
| Figure 3-33 Rake Lift Yoke..... | 3-51 |
| Figure 3-34 Cable Assembly..... | 3-52 |
| Figure 3-35 Cable Pulley Assembly..... | 3-53 |
| Figure 3-36 Lower Beam Center Pulley Installation..... | 3-54 |
| Figure 3-37 Corner Bracket / Pulley Installation..... | 3-55 |
| Figure 3-38 Hydraulic Cylinder Installation..... | 3-57 |
| Figure 3-39 Hydraulic Pump Arrangements..... | 3-58 |
| Figure 3-40 Hydraulic Manifold Block with Hydraulic Door..... | 3-59 |
| Figure 3-42 Single Acting Hydraulic Lift..... | 3-62 |
| Figure 3-43 Double Acting Hydraulic Lift..... | 3-62 |
| Table 3-9 Cylinder Bracket and Cylinder Rod Position Dimensions... | 3-63 |
| Figure 3-44 Screw Conveyor Trough Location..... | 3-66 |
| Table 3-10 Screw Conveyor Speeds..... | 3-67 |
| Figure 3-45 Typical Two-Section Door..... | 3-72 |
| Figure 3-46 Typical Two-Section Door..... | 3-73 |
| Figure 3-47 Bin Door Arm Detail..... | 3-74 |
| Table 3-11 Door Section Weights | 3-75 |
| Figure 3-48 Door Arm Stabilizer & Limit Switch Installation..... | 3-76 |
| Figure 3-49 Hydraulic Bin Door Cylinder Installation..... | 3-78 |
| Figure 3-50 Typical Hydraulic Piping with Automatic Hydraulic Bin Door / Door Cylinder Relief Valve..... | 3-80 |
| Figure 3-51 Retaining Wall Installation..... | 3-81 |
| Figure 3-52 Safety Cover Installation | 3-81 |
| Figure 3-53 Proximity Switch Installation..... | 3-83 |

| | |
|--|------------|
| Section 4 Operating Instructions..... | 4-1 |
|--|------------|

| | |
|--|-----|
| Figure 4-1 Typical control Panel Layout..... | 4-1 |
|--|-----|

| | |
|---|------|
| Figure 4-2 Master Control Switch Circuit & Single Phase Power Connection..... | 4-2 |
| Figure 4-3 Typical PLC Input / Output Layout..... | 4-3 |
| Figure 4-4 Typical timer Cam Switch and Cam-STR & TM..... | 4-10 |
| Figure 4-5 Load Detector Wiring..... | 4-11 |
| Figure 4-6 Load Detector Layout & Wiring..... | 4-13 |
| Figure 4-7 Load Detector Transformer Wiring..... | 4-14 |
| Figure 4-8 Autogard E-510 Power Monitor..... | 4-16 |
| Figure 4-9 Autogard Wiring..... | 4-16 |
| Figure 4-10 Siemens Soft Start..... | 4-20 |
| Figure 4-11 Typical Switch Inputs to PLC..... | 4-23 |
| Figure 4-12 Typical Control Panel Pilot Lights..... | 4-24 |
| Figure 4-13 Typical Amp Range Dial – Starter Overload..... | 4-26 |
| Figure 4-14 Typical Interlock Inputs to PLC..... | 4-28 |
| Figure 4-15 Typical Field Wiring Connections..... | 4-32 |

| | |
|--|------|
| Table 4-1 Compensation Settings –Square D..... | 4-13 |
| Table 4-2 Rake Drive Motor Load Detector Settings/Current Transformer Turns..... | 4-14 |
| Table 4-3 Autogard Settings..... | 4-17 |
| Table 4-4 Autogard Parameters for Automatic Rakes..... | 4-18 |
| Table 4-5 Summary of Factory Settings – Soft Start..... | 4-19 |
| Table 4-6 Programmable Controller Timer Addresses & Presets..... | 4-47 |

| | | |
|------------------|------------------------------|------------|
| Section 5 | Trouble-Shooting..... | 5-1 |
|------------------|------------------------------|------------|

| | | |
|------------------|-------------------------|------------|
| Section 6 | Maintenance..... | 6-1 |
|------------------|-------------------------|------------|

| | |
|--|-----|
| Weekly Inspections..... | 6-1 |
| Every Two Weeks..... | 6-2 |
| After Initial 10 Hours of Operation..... | 6-2 |
| After Initial 50 Hours of Operation..... | 6-2 |
| Every Six Weeks..... | 6-2 |

| | |
|--|-----|
| Table 6-1 PLC Counter Addresses and Presets..... | 6-4 |
| Table 6-2 Daily Plant Log Sheet..... | 6-5 |
| Table 6-3 Weekly Hoist Inspection Sheet..... | 6-6 |
| Table 6-4 Weekly Door Winch Inspection Sheet..... | 6-6 |
| Table 6-5 Weekly Rake Assembly Inspection Sheet..... | 6-7 |
| Table 6-7 General Inspection Sheet..... | 6-9 |





CB Series Rake Manual Installation, Operation & Maintenance

INTRODUCTION

Turbo Refrigerating is a supplier of icemaking and ice storage equipment. TURBO® does not engineer or design ice systems or ice plants. TURBO can provide assistance in locating qualified companies familiar with the installation and operation of TURBO rakes. Contact the factory at the address or telephone numbers listed at the end of this section.

Information on safety, installation, operation, maintenance and trouble-shooting is contained in this manual. If you have questions concerning any of these phases, contact TURBO or one of its distributors to ensure that you fully understand the instructions and guidelines.

You must read all of the information carefully and make sure that all personnel involved in the installation have also read and understood the information and safety instructions. This will help avoid injury to personnel and/or damage to the equipment. Both are valuable assets to your operation. Take the time to protect them.

Read the manual contents before you start your installation or operation. This will save time by ensuring that all necessary materials and tools are available when the equipment arrives.

History

TURBO has been producing equipment for the ice industry since 1960. The ice storage system described in this manual is part of a family of products designed specifically for the ice industry. TURBO® rakes and storage bins were introduced in 1967. There are three basic sizes in the hydraulic version (described in this manual) as well as two larger versions known as automatic ice rakes. The smaller hydraulic models range in capacity from 20 to 87 tons while the larger automatic ice rakes range from 100 to 300 tons of ice storage.

TURBO rakes have been used in USDA inspected installations.

USDA Design

All TURBO® ice storage systems are designed to meet USDA guidelines and meet rugged industrial standards which make them the most reliable in the industry. Each system is designed to make the loading and unloading of the ice storage system as safe and simple as possible. Regardless of size, all of the ice storage systems operate in basically the same simple yet reliable manner.

Read Safety Section before installing or using equipment

Operation

The TURBO® ice rakes are of the self-leveling, self-unloading type.

When ice is being loaded into the bin, the rake will periodically run forward and reverse to distribute the ice evenly throughout the rake bin. The hoist raises the rake assembly to keep it level with the ice surface during both the load and unload operation.

When ice is being unloaded from the bin, the rake will run in the forward direction only while the hoist lowers the rake to discharge the ice into the delivery system.

Loading the Ice Storage Bin

Ice produced on the icemaker is conveyed to the ice rake system and discharged into the storage bin containing the ice rake.

The ice rake, suspended above the ice, levels the pile of ice using TURBO's unique rake flite design, to ensure a totally uniform and level bed of ice. The rake can be operated in both the forward and reverse directions.

As the ice level in the ice storage bin rises, the rake controls lift the rake to maintain it above the bed of ice.

Unloading the Ice Storage Bin

The bin door is opened and the delivery switch is turned to the ON position. An optional automatic door is available to open the storage bin door when the delivery switch is turned on.

The ice rake lifting mechanism lowers the ice rake assembly onto the level bed of ice.

As the ice rake flites move forward, a layer of ice is moved into the open bin door and discharged into a screw conveyor (auger) located in the front of the rake bin and is transferred to . The screw conveyor (floor screw) transmits the ice to other ice conveying equipment.

Note:

TURBO does not manufacture, select, specify, or install screw conveyors.

The entire load and unload sequence is automatic and does not require the operator to be in contact with the ice or any moving parts in the ice storage system.

The continuous presence of an operator is not required although it is recommended. At the end of the day, the bin is empty (on a design day). The bin refills overnight and is full when personnel return to work.

All controls are adjustable to allow the load or unload rate to match the customer's production and/or delivery requirements.

Read Safety Section before installing or using equipment

Rake Variations

There are nine CB models in three basic rake sizes as shown in Table 1-1. The following table shows the standard capacities and space requirements for both the CB and automatic rake models. If your application is not covered in this table consult the factory for special variations and configuration

Table 1-1 Rake Variations / Capacities
CB Series

| Model | Capacity ¹ (U.S. tons of ice) | Approx. Shipping Weight (lbs.) | Floor Space Required ^{2, 3} (L x W x H) |
|-------|---|-----------------------------------|---|
| CB-20 | 20 | 2,000 | 24'-9" x 11'-6" x 9'-0" |
| CB-30 | 30 | 2,100 | 24'-9" x 11'-6" x 11'-10" |
| CB-38 | 38 | 2,200 | 24'-9" x 11'-6" x 13'-6" |
| CB-50 | 50 | 2,300 | 24'-9" x 11'-6" x 16'-4" |
| CB-31 | 31 | 3,000 | 29'-9" x 11'-6" x 9'-0" |
| CB-49 | 49 | 3,150 | 29'-9" x 11'-6" x 11'-10" |
| CB-59 | 59 | 3,250 | 29'-9" x 11'-6" x 13'-6" |
| CB-75 | 75 | 3,350 | 29'-9" x 11'-6" x 16'-4" |
| CB-87 | 87 | 3,500 | 29'-9" x 16'-6" x 16'-4" |

Notes:

¹ Capacity based upon ice density of 40 pounds per cubic foot (640 kg/cu M) for TURBO fragmented ice (CF & CAR models). For other ice products, correct capacity using the following multipliers:

| | <u>Correction Factor</u> |
|-------------------------------|--------------------------|
| TURBO TIG/TIGAR fragmented | 0.90 |
| VOGT tube ice (all diameters) | 0.85 |
| TURBO Marine flake ice | 1.05 |

² Includes space required for mounting control panel, rake bin door hydraulics, 24" clearance for base plate flanges on the vertical rake steel columns. In addition to the space listed above, most electrical codes also require 36" clearance in front of the electrical panel. Does not include space required for floor screw drive. All dimensions are subject to change without notice. Reference data sheet for installation dimensions.

³ Included is the rake assembly: girder liner, rake drive motor, hoist drive, hoist assembly including retractable three-phase electrical cord, , rake bin door, limit tube assembly, installation drawings, operating and maintenance manuals, floor screw limit switch assembly and controls for loading and unloading ice. Floor screw conveyor for ice delivery is not included. CB rakes include the bin structure. Electrical control panel includes controls and motor starters for all motors supplied. Includes motor starter for floor screw provided by others. Load detector and programmable controller controls are standard. Rake assembly is factory assembled for testing. Rake components are "match marked" and disassembled prior to shipment.

Read Safety Section before installing or using equipment

Controls

The controls for the ice rake operation are flexible and allow for the hoist and rake drive mechanism to be controlled by a programmable controller from interlocks on the TURBO® icemakers. A rake drive VFD was added in 2007 to:

- Reduce the loading on the steel chain
- Extend chain life span
- This feature is required on rakes with plastic chain.

Sanitary Ice

Every effort is made to minimize the potential for contamination of the ice in the storage bin. There are no fluid couplings or hydraulic components located over the ice.

Lubricants used on the sheaves and gear reducer located above the ice are all food grade. The rake is built for installation in USDA inspected facilities.

Ice Delivery

Since the rake drive can run in both directions (forward and reverse), the customer can choose where along the centerline of the rake he wants the ice to enter the storage bin. Ice can enter at the back or the front of the storage bin and still be leveled because of the flexibility in the controls. The amount of time the rake runs in either direction is easily set by the operator to match his particular needs.

TURBO recommends that the ice enter in the middle or towards the rear of the rake to optimize the leveling of the ice.

In addition to the icemaker and ice storage systems, delivery systems (to transport the ice to a remote delivery point) can also be supplied.

This product line includes:

- Pneumatic blowers
- Rotary valves (ice metering airlocks)
- Two and three position diverter valves (manual or automatic)
- Piping and fittings for the pneumatic system
- Stainless steel cyclones to drop the ice at the end of the pneumatic system

Ice can be delivered to several different locations easily and safely.

Optional Rake Features

Although TURBO designs and builds the ice storage system to be as flexible as possible, the standard system may not meet a particular application. TURBO can design a storage system to meet almost any need.

Optional features:

- Plated chain
- Stainless steel chain
- Stainless steel rake flites
- Nylon rake pads with UHMW girder liner
- Volumetric metering
- Dual ice storage bin systems to:
 - Reduce down time
 - Improve maintenance scheduling
 - Allows loading one bin while unloading the others improving ice quality
- False floors using PVC pipe to improve:
 - Air circulation
 - Ice quality

Associated Equipment

TURBO® TIG/TIGAR Ice Generators

In industrial applications where ice is being used for processing or for top icing, TURBO produces a series of wet ice generators called the TIG (R-22) and TIGAR (NH3) series. These icemakers are built with the same high quality standards and engineering as the TURBO® icemakers of the sixties. The only difference is that the icemaking process produces a slightly wetter ice and the standard sizing system used to produce dry, uniform ice nuggets is eliminated. As a result, a random shaped piece of fragmented ice is produced at a lower cost per ton.

In applications where totally dry, uniform ice is not required, the TIG/TIGAR series offers a low cost alternative.

Typical Applications

- Produce (broccoli, carrots, etc.) -- top icing in the field (trailer mounted units) or in the processing area
- Concrete icing
- Ingredient icing (bakeries)
- Fish icing
- Poultry icing
- Chemical and dye processes
- Emergency cooling loads
- Ice slurries
- Catering trucks
- Salad bars or display ice
- Food processing

Read Safety Section before installing or using equipment

In addition to the icemaker and ice storage systems, delivery systems (to transport the ice to a remote delivery point) can also be supplied.

This product line includes:

- Pneumatic blowers
- Rotary valves (ice metering airlocks)
- Two and three position diverter valves (manual or automatic)
- Piping and fittings for the pneumatic system
- Stainless steel cyclones to drop the ice at the end of the pneumatic system

Ice can be delivered to several different locations easily and safely.

Special Applications

TURBO is in the business of supplying equipment to meet the needs of the customer. If you have an application or a need that is not discussed here, contact:

Turbo Refrigerating, LLC

Sales Department

1000 West Ormsby, Suite 19

Louisville, KY 40210

Phone: 502-635-3000

Fax: 502-635-0479

Web Site: WWW.turboice.com or WWW.vogtice.com

Customer Service

The TURBO service department provides assistance for all customer needs. TURBO conducts training schools at the factory and at various locations throughout the world.

The model and serial number of your TURBO equipment is located on the data nameplate attached to the electrical control panel. Please refer to the model and serial number when making inquiries about the equipment. This will enable our personnel to handle your questions quickly and accurately.

Read Safety Section before installing or using equipment

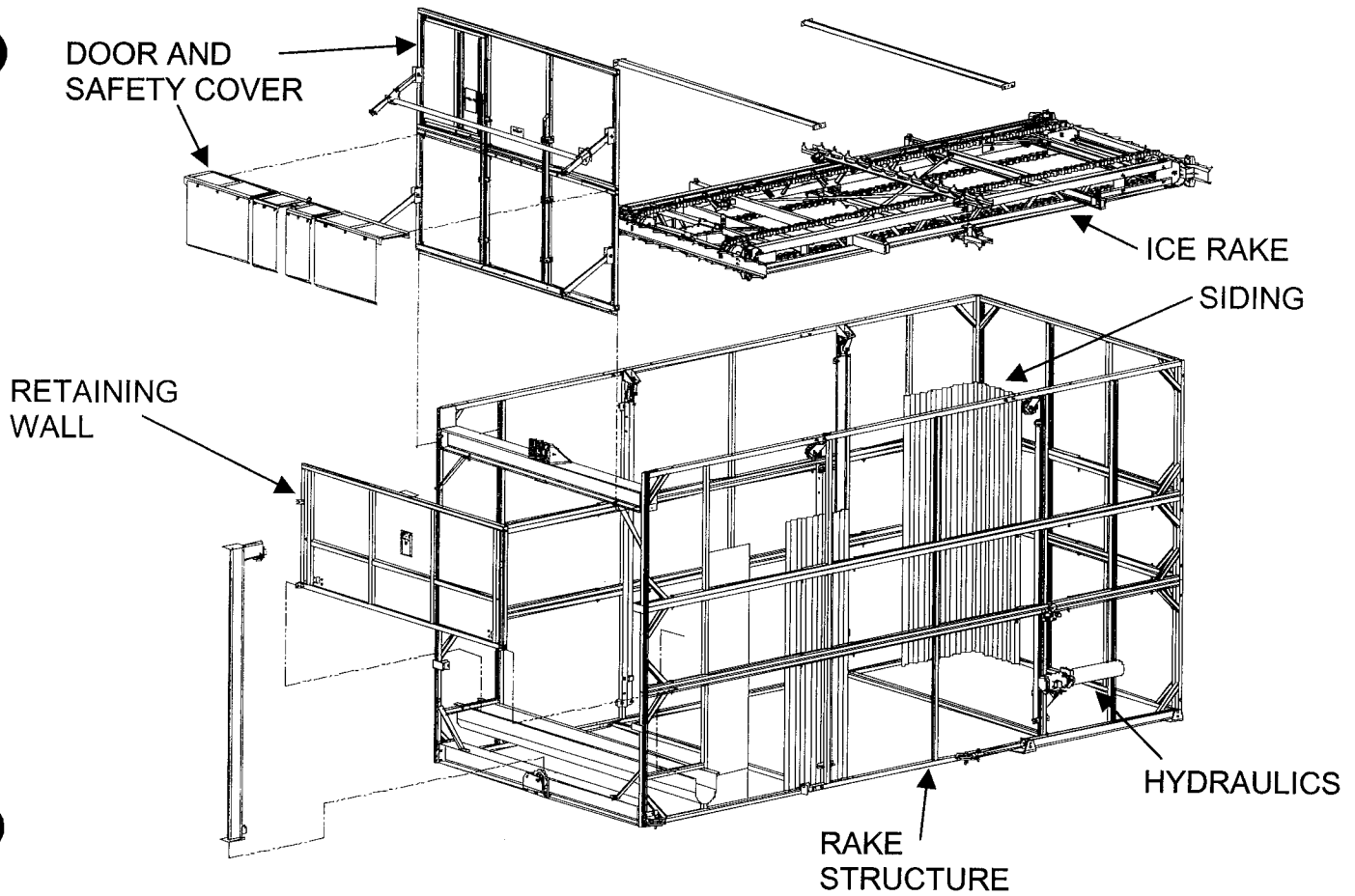


Figure 1-1 Typical CB Rake Components

Read Safety Section before installing or using equipment

High Values

TURBO highly values its friends and customers in the industry. Please remember to:

Think safely – act safely.

Understand operating procedures and dangers of the equipment.

Remember to think before you act.

Before you act, understand the consequences of your actions.

Observe equipment warnings and labels.



CB Series Rake Manual Installation, Operation & Maintenance

SAFETY

Here are some safety points to keep in mind when creating an efficient yet safe working environment.

Safety Definitions

Statements or labels in this manual or on the product preceded by the following words are of special significance:

Warning

Indicates severe personal injury or death will result if instructions are not followed.

Caution

Indicates a strong possibility of severe personal injury or death if instructions are not followed.

Important

Indicates hazards or unsafe practices which could cause minor personal injury or product or property damage.

Note

Gives helpful information.

Machinery Is Dangerous

Machinery can hurt you if you are not careful. Use caution during assembly and operation of equipment.

ALWAYS:

- Read the entire manual first.
- Use common sense and be careful.
- Have enough manpower.
- Have the proper tools.
- Follow directions and illustrations.
- Check to see that all equipment meets applicable installation codes for your area as well as state and federal requirements.
- Have sufficient safety warnings on all equipment.
- Make sure all safety devices and guards are in place.

WARNING! Read this section first. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Note:

The warning labels attached to the control panel, rake bin door, retaining wall and access door should be observed. They are shown in Figures 2-1, 2-2 and 2-3.

If all labels are not attached and visible or labels start to become illegible, contact:

Turbo Refrigerating

Service Department

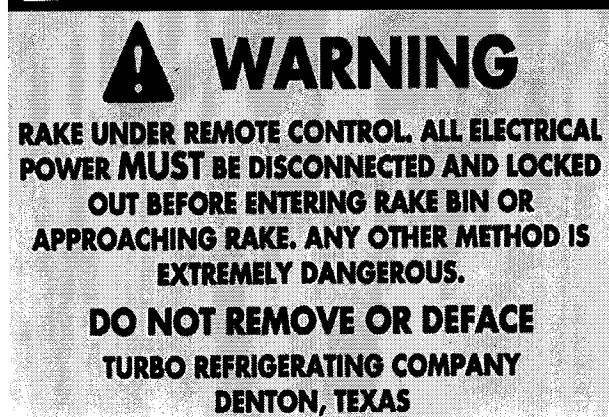
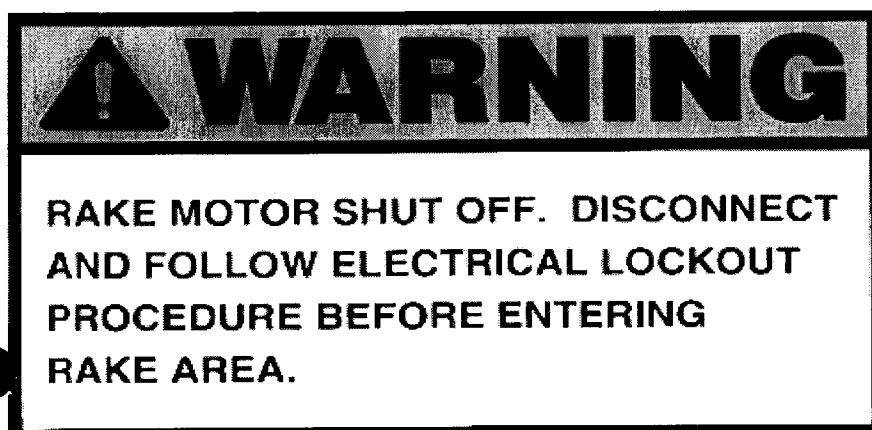
1000 West Ormsby, Suite 19

Louisville, KY 40210

Phone: 502-635-3500

Fax: 502-635-3024

Web Site: WWW.turboice.com or WWW.vogtice.com



IMPORTANT NOTICE

CONTROL PANEL IS TO BE LOCATED NEAR CLEAR PANEL ON RAKE BUILDING FOR GOOD VISIBILITY OF INSIDE RAKE.

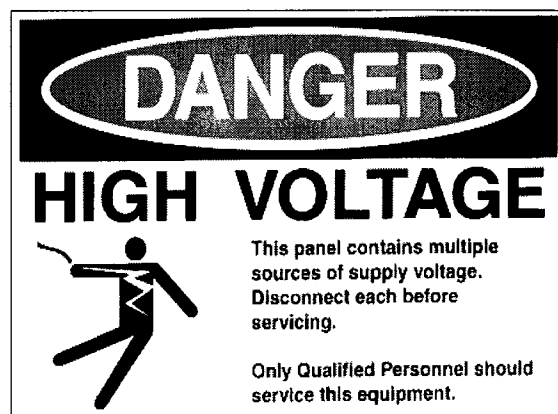


Figure 2-1 Warning Labels on Control Panel

WARNING! Read this section first. Failure to carefully follow these instructions could result in permanent injury or loss of life.



Figure 2-2 Warning Label on Rake Bin Door and on Retaining Wall

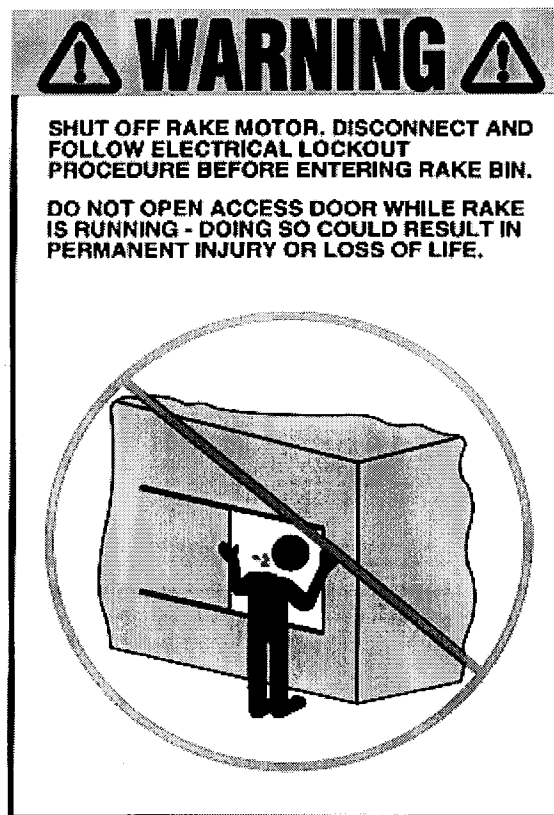


Figure 2-3 Warning Label on Access Door

WARNING! Read this section first. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Involve Your People

Before operating equipment, have the people involved in the operation or maintenance of the equipment meet to discuss the dangers and safety aspects of the TURBO® ice storage equipment.

- Warn them of the danger of miscommunication.
- Turn electricity off and lock it out when working on the rake.
- Have a responsible person on duty to ensure that the electricity stays locked out to protect the people working on the equipment.

WARNING

This is an automatic machine. Motors may start without warning. Never approach the rake unless all electrical power is disconnected and locked out.

Never get under the rake. Be sure there is no possibility of anyone accidentally getting into the bin. If it is not possible to lower the rake to a secure position for service, cables or chains capable of supporting the rake mechanism should be used to secure the rake in place. This also applies to a rake resting on top of the ice pile. Voids in the ice pile or shifting of the ice could cause the rake to drop without warning.

Do NOT allow access to the top of the rake. Be sure there is sufficient guarding to keep anyone from falling into the bin.

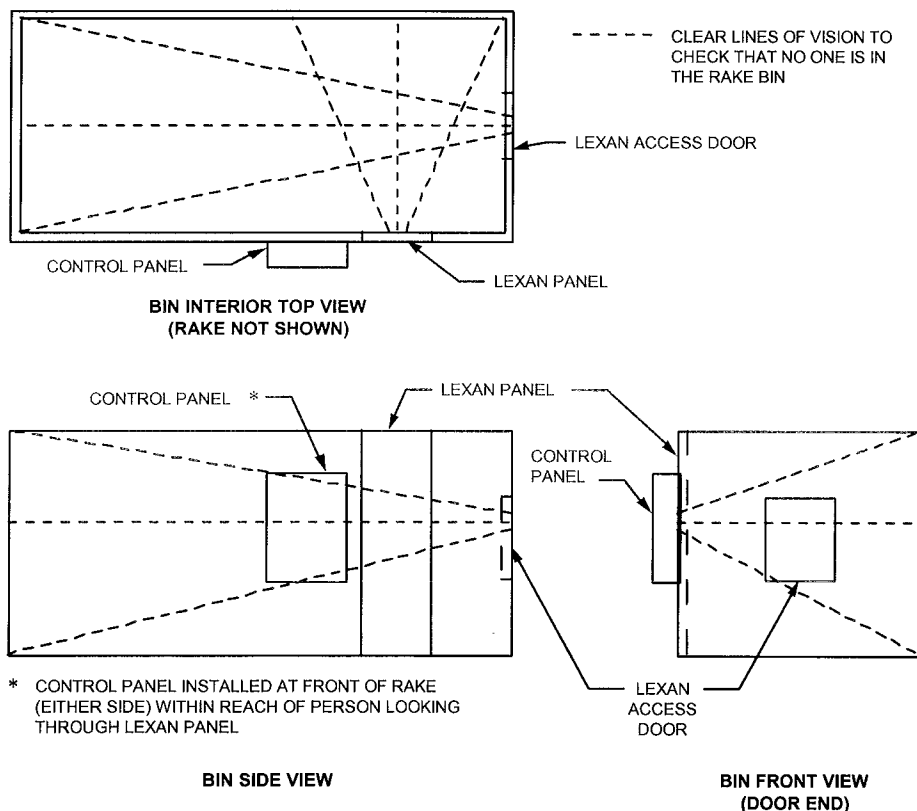


Figure 2-4 Good Visibility of Rake Bin Interior

Never open the control panel without disconnecting and locking out electrical service. A qualified electrician should perform all electrical work.

When working in the rake bin, after all power is disconnected and locked out, always work with at least two (2) people present.

A sliding clear lexan panel is located on the rake bin door for observing the rake operation and for service access to the rake.

WARNING

Never open the access door and look inside the rake without locking out the electricity. The rake mechanism is only three (3) inches from the bin door and will pass the opening during load or unload sequences. Refer to Figure 2-3. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Although TURBO does not supply conveying equipment, any conveyors used in association with the operation of TURBO equipment must be sufficiently guarded to prevent injury and installed in compliance to all local, state and federal safety codes.

If an outside contractor is installing or servicing your rake, require him to furnish you with a certificate of insurance before performing any work on your equipment.

Notes:

- 1. Refer to the conveyor manufacturer's instructions and warnings contained in this manual.**
- 2. Refer to the safety lock out procedure in this section.**

Emergency Stop Button

A push/pull mushroom head emergency switch (Reference Figure 2-1) is on the control panel door for emergency cut-off of the control circuit power. This button is **not** to be used for service or **lock out**. **This is an emergency stop button only.**

Master Control Switch

A selector switch is provided to control the rake OFF/ON operation. This is **not** to be used for **lock out** of the electrical power during service. To **lock out** the rake controls:

1. Pull disconnect and **lock out** all electrical service.
2. Turn selector switch (provided) to the OFF position.
3. Lock control panel with lock (not provided).

Retaining Wall

The retaining wall is a safety cover for the floor screw conveyor (not supplied by TURBO). Safety switches are provided to prevent operation of the rake system without the retaining wall properly installed. Do **NOT** operate the rake without the retaining wall or safety switches in place.

WARNING! Read this section first. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Stored Energy

Hydraulic door operators are standard on all rakes. These devices use high-pressure hydraulic pumps to operate (lift) the door. Before performing service work on the door cylinder, power unit, or hoses the door should be lowered to the closed position or chained in place if it can not be lowered. After the door has been lowered or secured, the electrical power should be locked out and the pressure bleed from the hydraulic system before proceeding.

Stored energy may also be present in the form of rake flites, chain, or rake drive being in a bind as a result of an overload. Before entering the rake to service the chain, rake drive, flite pads, or other components the rake should be free of any binding or other obstructions. The rake can be manually operated to raise and lower the rake as well as operate it in forward and reverse to ensure it is properly operating and free of binding or obstructions.

Stored energy may also be present in the form of tension on the rake lift cables or the door lift cable. Before attempting to remove or replace cables the rake should be lowered to the rake stops or chained in place to relieve the tension on the cables and then the power should be **locked out**.

CONVEYOR MANUFACTURER'S INSTRUCTIONS AND WARNINGS

TURBO does not install conveyors. It is the responsibility of the contractor, installer, owner, and user to install, maintain, and operate the conveyor, components, and assemblies in such a manner as to comply with the Williams-Steiger Occupational Safety and Health Act (OSHA) and with all state and local laws and ordinances and the American National Standard Institute (ANSI) safety code.

In order to avoid an unsafe or hazardous condition, the assemblies or parts must be installed and operated in accordance with the following minimum provisions.

1. Conveyors shall not be operated unless all covers and/or guards for the conveyor and drive unit are in place. If the conveyor is to be opened for inspection, cleaning, maintenance, or observation, the electric power to the motor driving the conveyor must be **locked out** in such a manner that the conveyor cannot be restarted by anyone (however remote from the area) until conveyor cover or guards and drive guards have been properly replaced.
2. If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence in accordance with ANSI standard B20.1-1976, with special attention given to section 6.12.
3. Feed openings for shovel, front loaders or other manual or mechanical equipment shall be constructed in such a way that the conveyor opening is covered by a grating. If the nature of the material is such that a grating cannot be used, then the exposed section of the conveyor is to be guarded by a railing or fence and there shall be a warning sign posted.
4. Do not attempt any maintenance or repairs of the conveyor until power has been **locked out**.

5. Always operate conveyor in accordance with these instructions and those contained on the caution labels affixed to the equipment.
6. Do not place hands or feet in the conveyor.
7. Never walk on conveyor covers, grating, or guards.
8. Do not use conveyor for any purpose other than that for which it was intended.
9. Do not poke or prod material into the conveyor with a bar or stick inserted through the openings.
10. Keep area around conveyor drive and control station free of debris and obstacles.
11. Always regulate the feeding of material into the unit at a uniform and continuous rate.
12. Do not attempt to clear a jammed conveyor until power has been **locked out**.
13. Do not attempt field modification of conveyor or components.

Disconnecting and **locking out** the power to the motor driving the unit provides the only real protection against injury. Other devices should *not* be used as a substitute for **locking out** the power prior to removing guards or covers. We caution that use of secondary devices may cause employees to develop a false sense of security and fail to **lock out** power before removing covers or guards. This could result in a serious injury should the secondary device fail or malfunction.

There are many kinds of electrical devices for interlocking of conveyors and conveyor systems such that if one conveyor in a system or process is stopped, other equipment feeding it or following it can also be automatically stopped.

Electrical controls, machinery guards, railings, walkways, arrangement of installation, training of personnel, etc. are necessary ingredients for a safe working place. It is the responsibility of the contractor, installer, owner, and user to supplement the materials and services furnished with these necessary items to make the conveyor installation to comply with the law and accepted standards.

Conveyor inlet and discharge openings are designed to connect to other equipment or machinery so that the flow of material into and out of the conveyor is completely enclosed.

SAFETY LOCKOUT PROCEDURE

Effective November 1, 1989

I. Purpose

The purpose of this procedure is to prevent injury and/or death to personnel by requiring that certain precautions be taken before servicing or repairing equipment. It has been developed and implemented so as to comply with 29 CFR 1910.147, of the Occupational Safety and Health Act, as amended.

These precautions include:

1. Shutting off and locking out electrical power.
2. Releasing pressure in pneumatic and hydraulic systems.
3. Effectively isolating those portions of equipment and machinery that are energy intensive and are being serviced or maintained.

II. Scope

This procedure includes those employees whose duties require them to do maintenance work on power-driven equipment. It covers the servicing or maintenance of machines or equipment in which the unexpected energization, start-up or release of stored energy could cause injury.

III. Supervisory Responsibility

It is the responsibility of all supervisors having contact with such operations to:

- A. Instruct all affected employees as to the content of this program.
- B. Ensure compliance with this procedure.

IV. Safety Locks

Safety locks and keys will be issued to designated employees. Locks and keys must be returned to the plant manager when an employee transfers to another assignment or terminates his employment. Safety and supervisory personnel shall have access to master keys for protective locks, and under certain controlled conditions, be available to assist in the removal of safety locks.

Safety locks are painted yellow for electricians and red for maintenance personnel. These locks are to be used only for locking out machinery, tooling, and equipment described in this procedure.

V. Safety Department Responsibility

It is the responsibility of the Safety Coordinator to inspect the plant on a periodic basis to ensure compliance with this procedure. If it is determined that this procedure is not being complied with, immediate corrective action will be initiated. Wherever possible, such action will be taken in conjunction with the first-line supervisor; however, higher level management personnel will be involved if the violation is of a serious or repetitive nature.

VI. Rules and Regulations

The following rules and regulations have been established and are mandated:

- A. Any electrician or maintenance person, whose duties require that he or others be exposed to the hazards of electrical shock or moving equipment, must perform those duties in a safe and uncompromising manner. The following steps outline such precautions:
 - 1. The employee must understand the equipment with which he is working and its hazards.
 - 2. When working with electrical equipment where the accidental starting of such equipment or release of stored energy would create a hazard, the employee must turn off all power to the unit or use energy isolating devices and apply his personal lock, and have the supervisor of that area apply his personal lock. At all times when maintenance is being performed on our equipment, that equipment will have 2 locks on it, one by the person performing the maintenance plus the one of the supervisor.
 - 3. In instances where multiple circuits are in a circuit breaker box, an attaching mechanism will be placed on the outside of the box to allow that box to be locked out and prevent the door from being opened.
- B. Each employee who performs the duties prescribed above will be provided with an individual safety lock and one key. If more than one employee is assigned to a task, each employee is required to place his own lock and tag so the controls cannot be operated, even though another person may have completed his own task, and remove his own lock.
- C. If the equipment controls are so located that only one lock can be accommodated; a special attachment that accommodates several locks must be used. This attachment will be issued to all designated employees.
- D. Should an employee be required to work on another piece of equipment and need to leave his lock on the present equipment, another lock must be obtained from the plant manager.
- E. Should it be necessary to operate a piece of equipment which is locked out, every effort should be made by supervision to locate the employee whose lock is on the equipment. If that employee cannot be located, the supervisor may obtain a master key for the lock. The supervisor must personally assure himself that it is safe to remove the lock. The lock should then be returned to the proper employee.

WARNING! Read this section first. Failure to carefully follow these instructions could result in permanent injury or loss of life.

This procedure must be used with extreme caution and good judgement. There is danger that the employee involved will return thinking that the machine is still locked out, when it has actually been turned back on.

F. If a machine is locked out and it is necessary to leave the area, recheck the lock upon returning to make sure that the machine is still locked out. While supervision will make every attempt to avoid the removal of locks, there may be situations when it must be done. This recheck is for your protection.

G. It is sometimes necessary to operate equipment for purposes of testing or making adjustments prior to the actual completion of the work. It is recognized that electricians must work on live circuits from time to time, particularly when trouble-shooting, but extreme caution must be used under these circumstances. Never work alone when changing live wiring.

VII. Outside Contractors

Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this lockout and tag procedure, such personnel are to be informed of this procedure by the person responsible for their work activity and are to direct them to follow its requirements. Failure to do so shall require that they do not be permitted to continue working in the plant.

VIII. Failure to Follow Procedures

These procedures have been developed to protect employees from serious injury. It is necessary that all employees follow them. Those employees not complying with the provisions in this procedure will be subject to disciplinary action, up to and including discharge.



INSTALLATION & ASSEMBLY REQUIREMENTS

This section includes step-by-step instructions on assembling and installing a TURBO® rake system. Installation of the rake system will require a qualified electrician and two (2) to four (4) people with good mechanical skills.

The TURBO® rake has been pre-assembled, tested, and inspected at the factory prior to packing and shipping.

Assembly Sequence

1. Site preparation
 - Packing slip check
 - Getting started / helpful hints
 - Tools required
 - General requirements
 - Refrigerated versus non-refrigerated storage
 - Packaged ice applications
 - Industrial applications
 - Air circulation
 - Drainage
 - False floors
 - Electrical
 - Three-phase
 - Single-phase
 - Disconnects
 - UL listing
 - Lighting
 - Access doors
 - Steel structure finish
 - Floor Screw
 - Above Floor Screw Installation
 - Below floor Screw Installation
 - Retainer wall installation
2. Delivery inspection
3. Bin structure installation
 - Assembly of rake bin.
 - Electrical components installation
 - Electrical conduit
 - Electrical counterweight installation
 - Additional guidelines are provided in the installation drawings. These drawings show the general system.
4. Rake hoist pulleys installation-lifting points
5. Rake Guide Installation
6. Rake assembly
 - Electrical components
 - Electrical conduit assembly
 - Electrical counterweight assembly
7. Rake Lift Assembly Installation
 - A. Rake Pulleys-Upper I-beam
 - B. Rake Pulley-Lower I-beam
 - C. Corner Pulley Assembly
 - D. Hydraulic cylinder mounting bracket and cylinder installation
 - E. Hydraulic power unit and manifold block
8. Rake bin liner installation
 - Charging with hydraulic oil.
 - F. Lift cable to lift yoke
 - Corrugated aluminum liner (standard)
 - High Density Polyethylene (HDPE) bin liner (optional)
9. Screw conveyor selection and installation guidelines
10. Rake bin door assembly and installation
11. Rake bin door lifting mechanism installation/cable assembly installation
 - Hydraulic operated door mechanism (standard)
 - Manual hand winch (optional)
12. Retainer wall and safety switch installation
13. Electrical components installation
 - Three-phase power
 - Control panel
14. Pre-start-up cleaning procedure
15. Installation and start-up checklist

IMPORTANT: Pay special attention to bold print or boxed in paragraphs. Following information is essential for a safe and efficient installation. Refer to section 2 – Safety for more information.

SITE PREPARATION

CB rake systems are supplied with a steel structure to form the storage bin and support the lifting mechanism for the rake and door assemblies. Installation of this structure is required before assembly of the rake mechanism. The following guidelines should assist in properly preparing for the installation of the equipment supplied by TURBO as well as components supplied by others for the ice storage system. Any questions concerning site preparation should be discussed with a qualified TURBO distributor or TURBO application engineer.

Packing Slip

Refer to the packing slip for the location of all components and hardware. All hardware is in individual containers packed in a wooden crate(s). Figure 3-1 shows an example of a page from the packing slip.

As shown in Figure 3-1 (Packing Slip). Although the hardware for the rake pulley and lower I-beam are in the same box, they are packed and marked separately for ease of installation. The packing slip shown is for example only. Your actual packing slip may vary in appearance but will contain the same information. The contents of your shipment should be compared and verified upon receipt. Report any shortages to TURBO immediately – Parts Department @ 940/387-4301.


| Packing List | | | | |
|--|------|---|-----|--|
| CB30 AFS | | | | |
| Group | Item | Packaging Description | Qty | |
| Door | 1 | Bottom Section w Liner and bottom angle | 1 | |
| Door | 2 | Second Section w Liner | 1 | |
| Door | 3 | Third Section w Liner | - | |
| Door | 4 | Fourth Section w Liner | - | |
| Picture may not reflect all door sections | | | | |
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Figure 3-1 Typical Packing Slip

Read Safety Section before installing and operating equipment

The packing slip indicates the quantity and size of the hardware and identifies the serial number and model of the rake for reference if you have questions and need to contact TURBO for assistance.

To Help You Get Started

- Read instructions completely before assembling.
- Gather all required tools.
- Check the parts against the packing slip as you unpack the rake. Report missing parts immediately.
- Establish front and rear, and left and right of the rake by facing the rake door. Refer to Figure 3-2.
 - From the outside, the door is at the front of the rake.
 - As you face the door from the front, the left is the left of the rake; on the right is the right of the rake.

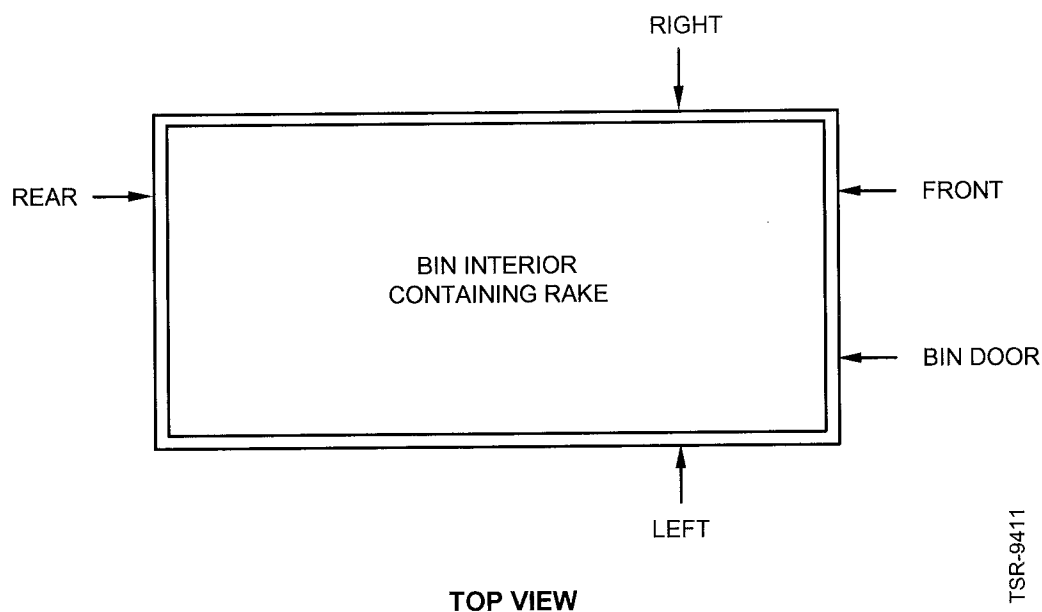


Figure 3-2 Rake Bin Orientation

Helpful Hints

If the floor screw is recessed (below the floor level), install it before assembling the structure. Refer to Figure 3-54. The floor screw opening should be securely covered (temporarily) during installation for safety.

Do not discharge ice directly from the icemaker into the bin. Use a screw conveyor (auger) to transport the ice to the ice entry opening in the storage bin.

TURBO recommends that the ice enter the rake bin at the center. This ensures a more uniform leveling of the ice pile and prevents surging during unloading.

Read Safety Section before installing and operating equipment

All screw conveyors should be pitched (1/8 inch per 10' foot minimum) to drain:

- Melting snow
- Ice fines (slivers of ice)
- Condensation
- Water accidentally dumped into the icemaker discharge slide
- Cleaning solutions used to clean the evaporator or upper frame

The floor screw may be installed level to ensure a better fit with the bottom of the bin door but can also be pitched for drainage. Refer to the rake isometric drawing.

TOOLS

The following is a list of tools required for safe erection and assembly of the ice handling system:

- Wrenches and sockets (up to 1-1/8")
- Phillips and standard screw drivers
- Level (4' long)
- Tape measure (75' long)
- Pry bar
- Chain hoists (two – 1 ton) or come alongs (two – 1,000#)
- Allen wrenches (1/8" to 1/2")
- Chains (two – 3/8", 10' long minimum)
- Electrical drill (1/2") and assorted drill bits
- Amp probe
- Voltage tester
- Continuity tester
- Framing Square
- Steel pipes (four – approximately 2" in diameter and 12" long)
- Forklift or crane
- Bucket (5 gallon, clean)
- Tin snips

General Requirements

Installation of a concrete pad and building to enclose the rake steel is recommended for complete installation of an ice storage system. Although the rake provided by TURBO could be installed indoor or outdoor on any hard surface, indoor installation on a concrete slab is recommended for sanitation reasons since the top of the rake is open.

If the ice is to be used for a non-sanitary application in which the quality and contamination of the ice is not a factor, the rake system could be installed outdoors. However, even in these applications a cover must be provided over the rake to prevent rain, snow, or sleet as well as people and from entering the bin. Excessive moisture in the bin will cause severe bridging of the ice making it difficult – if not impossible, to remove the ice without damaging the rake mechanism.

The concrete slab should be of sufficient thickness to support the:

- Static load of the ice based on an ice density of 40 pounds per cubic foot
- Rake steel structure
- Rake mechanism
- Rake bin door assembly
- Screw conveyors
- Machinery or equipment required to service or maintain the rake system
- Any equipment located above the rake – ice makers, storage, etc.

Access by a forklift is typically required to transport some of the heavier components of the rake mechanism during service or maintenance. In determining the width and length of the slab, sufficient space must be provided on all sides and from the top of the rake to permit access for service. In general, a minimum of three (3) feet should be provided around the rake. This space is in addition to the floor spaced required for the rake steel overall dimensions. Consideration should be given to access to such components as the control panel, breaker panels or disconnects (by others), hoist drive, removal of rake drive or hoist motor, access to the screw conveyor drive and removal of the rake drive chain during periodic replacement.

Refrigerated Versus Non-Refrigerated Storage Bin

The TURBO rake mechanism will operate in either a refrigerated or non-refrigerated storage bin. The decision to refrigerate the storage bin is based on the application of the ice. In general, the lower the bin storage temperature, the higher the quality of the ice delivered to its final destination. All commercially produced ice has some moisture on the ice when it enters the storage bin. This moisture acts as a “glue” to bond the ice together. As the rake levels the ice by moving in the forward and reverse direction, the amount of bonding is reduced by the rake flites as they spread the ice out and the ice “cures”. The less bridging or bonding of the ice that occurs when it is cured at the lower temperatures the less snow is produced in the delivery operation. Cured ice is also easier to transport in the rake and in the delivery system conveyors, resulting in less wear and maintenance of the rake system. The following temperature ranges can be used as guidelines for the final storage temperature for the applications indicated. The final temperature for the storage bin can be adjusted after installation to achieve the best balance between the ice quality and the cost to refrigerate the storage bin.

Packaged Ice Applications

Ice that is produced and sold by the bag in convenience stores or other retail outlets requires a dry, loose product. In addition to the quality of the ice in the ice storage bin, consideration has to be given to the cure time and temperature of the ice after it is bagged.

When the bagged ice is transported to a bag storage area, the temperature of the ice must still be maintained at a level that prevents excessive moisture from collecting on the ice. Excessive moisture will cause the ice to bridge when the bags are placed in the cold storage vault.

Turbo recommends that the ice storage bin (bulk storage) should be maintained from 8-15°F for the best results. Economic factors may influence the final design temperature. The reduction in the amount of ice put in the bag as a result of poor coil performance or proper air circulation (See Air Circulation for details) should be factored in when evaluating the size of the coils and final room temperature. As the design temperature is lowered, the initial cost of the cooling equipment as well as operating (more refrigeration capacity required) and maintenance cost will increase but the quality of the product and

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overall handling of the product should improve. Acceptable results have also been obtained with bulk storage temperature in the 15-26°F range. Temperatures above 26°F have a tendency to produce results similar to non-refrigerated bins and are not recommended.

Refrigeration coils for the cold storage must be designed for the water load of the ice as well as the actual cooling load, and other loads and losses. Problems can result if the coils are undersized and can not handle the water load. This can result in excessive defrost cycles or periodic fluctuation of the temperature above freezing. Both conditions can result in poor quality and increase the amount of snow produced by the system due to bridging of the ice.

Produce/Fish/Poultry Top Icing Applications

In many applications, the ice is used for the cooling effect (BTUs) it has in the process or product it is being used to cool. Although important, additional snow, "wet" ice, and ice sizing are not the main factors in determining the storage temperature for such applications. In many of these applications, the presence of snow or moisture on the ice may even be desirable. Refrigerated storage may not be required to store the ice for short time periods less than three (3) days. High storage room temperatures can reduce this time.

The two examples above are not intended to cover all of the possible uses of the ice being stored. However, the factors discussed apply to most applications. Some other factors to consider include:

- a. The length of time the ice will remain in bulk storage. TURBO recommends removing all the ice from the storage bin every 7-10 days for storage temperatures in the 8-15°F range. As the storage temperature increases, the length of storage time decreases. Non-refrigerated bins storage is recommended for three (3) days maximum. In all storage bins, the ice at the bottom of the bin begins to pack as the storage time increases. If the bin was emptied on a daily basis this would not be a problem. However, variations in daily production generally make it impossible to empty the bin on a daily basis, and the ice at the bottom becomes difficult to remove without damage to the rake mechanism.

Note:

1. In some cases a two- (2) rake bin system can be used in place of one rake. This allows one bin to be emptied while the second bin is being filled. In the two-bin system all the ice can be removed on a regular basis thus preventing the build-up of "blue" ice at the bottom.
 2. Regardless of the storage temperature, TURBO recommends regular cleaning of the interior of the storage bin. Cleaning frequency should be based on the local requirements and regulations as well as on-site experience with the system. The bin should be cleaned a minimum of once a year regardless of the application to prevent the formation of a solid layer of ice at the bottom of the storage bin.
- b. Selection of coils for storage bins that are refrigerated should be sized by a qualified contractor to ensure that the coils are properly sized to handle the moisture on the ice without the need for excessive coil defrost time or excessive frequency of defrosting the coils. The coils must also be of sufficient capacity to maintain the storage temperature below 32°F at all times regardless of the conditions. If the temperature is allowed to fluctuate up and down above the freeze point, the components of the rake system will be continuously wetted and then dried. **The continuous wet/dry cycle can cause the excessive build-up of residue and contaminates as a result of the evaporation of the water on the surface of the components. In some cases, the water quality may be such that this process will cause excessive corrosion of the components.** The rake flite

Read Safety Section before installing and operating equipment

chain, rake sprockets, rake girders and even stainless steel components will "rust" under these conditions.

In the case of stainless steel components, the oxidation that occurs on the surface can discolor the surface or the mineral deposits will streak leaving the appearance of rusting. If the problem is not corrected, localized pit corrosion of the stainless steel will eventually occur.

Air Circulation

If the storage bin is refrigerated, the coil should be located to discharge the air down the center of the bin to ensure air is circulated throughout the bin. Large attic fan(s) can be located at the front of the refrigerated or non-refrigerated bins above the rake bin door to discharge air further into the bin. With the additional low energy fan, the cooling coils can be located in other parts of the room that are more convenient or reduce the installation cost and the volume of air circulated inside the bin can be significantly increased without affecting the selection or installation of the cooling coils.

As indicated above, space is required around the rake bin for service and maintenance. This space also creates a "dead space" between the bin and the storage room walls. Heat infiltration can create a warm spot in the rake that can cause the temperature of the ice to increase above the freeze point if the bin is in direct contact with the wall. Bins located next to exterior walls exposed to direct sunlight need to be properly designed to ensure that the service desired is obtained. Proper design and installation of the storage room in which the bin is located will prevent such problems from occurring.

Proper air circulation ensures higher quality and easier to handle ice in refrigerated and non-refrigerated bins and is recommended for all applications. In non-refrigerated bin the use of fans is optional.

Drainage

Periodic cleaning is required for all ice storage bins. In designing the room, consideration should be given to isolation of the storage room so that the temperature of the bin can be elevated above freezing to permit easy cleaning and wash down of all surfaces in the bin. A floor drain should be located inside the storage bin and connected to a suitable drain location to allow the water to be drained during the cleaning process.

If a below freezing storage is used, it may be necessary to heat trace the drain connection and piping to ensure that it remains open while the ice is melting. Heat tracing may also be required in above freezing storage bins for the same reasons during normal operation and during the cleaning process. In most cases a 1-1/2" to 3" drain line should be adequate.

Note:

Highly chlorinated water should be avoided for cleaning due to the highly corrosive effect on all materials including stainless steel.

False floors

A false floor with the glycol loop prevents the build-up of the solid ice mass at the bottom of the rake and reduces the maintenance time required for periodic wash down of the rake interior. The rake can be emptied and the glycol loop operated to melt the remaining ice in the rake bin eliminating the need for jackhammers or other means of mechanical removal of the ice. Contact TURBO for additional

Read Safety Section before installing and operating equipment

information on false floors. Although a number of methods may work, only one will be outlined here based on previous installations.

New construction: A 1-1/4" polyethylene pipe coil is embedded in the concrete on 6" centers in the area the rake will be placed. Provisions are made to connect the piping to a source of propylene glycol that is connected to a source of heat such as the cooling tower waste heat or other heat sources that can be reclaimed. A typical 10-foot by 20 foot CB rake would require approximately 500-600 feet of pipe.

The concrete slab inside the steel containing the rake assembly would be elevated to create a raised slab approximately 3" to reduce the space between the bottom of the rake and the floor. This would require approximately 2-3 yards of concrete to create the false floor containing the polyethylene pipe.

Existing rakes / Structures: If the false is to be added to an existing rake or a new rake for which the building floor has already been poured, the false floor can be poured inside the rake steel as described above.

Electrical

Both three-phase and single-phase electrical power is required to operate the rake system.

Three-Phase Power

The rake motor and hydraulic pump are both three-phase motors. A source of three-phase suitable to handle the motor load indicated below is required:

Table 3-1. Full Load Motor Amps

| * Rake Drive | 208-230/3/60 | 460/3/60 | 575/3/60 | 200/3/50 | 380-400/3/50 |
|----------------|--------------|----------|----------|----------|--------------|
| HP | 1.5 | | | 1.0 | |
| FLA | 6.6A | 3A | 2.4A | 4.8A | 2.3A |
| Hyd Pump Motor | 208-230/3/60 | 460/3/60 | 575/3/60 | 200/3/50 | 380-400/3/50 |
| HP | 1 | | | 3/4 | |
| FLA | 4.6A | 2.1A | 1.7A | 3.7A | 1.8A |

- Note: For rakes with VFD Rake drive motor control, use 60hz ratings.

TURBO does not provide the circuit breakers (main or branch) or disconnects for the motors. Breakers and / or disconnects must be provided by others at installation as required to meet all local, state and federal safety and code requirements.

Three-phase electrical power to the rake drive located on the interior of the rake bin is provided through a four-wire power cord that is extended and retracted by a counterweight and pulley assembly described later. Rigid conduit inside the rake bin is provided with the rake. Field connection is required for the conduit and counterweight system. Disconnects required for the power cord to meet local, state or federal code requirements or regulators are not provided and must be supplied by others.

Single Phase

The standard controls for the rake system are provided with 115 volt, single phase, 60-hertz power. Optional 230 volt and 50 hertz are available. Orders specified for 230/1/60 operation are provided with

Read Safety Section before installing and operating equipment

standard 115/1/60 controls with a step down control circuit transformer (230 volt primary/115 volt secondary) unless specified otherwise. The control circuit is rated at 10 amps.

TURBO does not provide the circuit breaker for the control circuit. A breaker must be provided by others at installation as required to meet all local, state and federal safety and code requirements.

Note:

The National Electric Code requires a minimum of 36" and up to 48" clearance in front of the electrical enclosures. State or local codes may require additional clearance. The contractor is responsible for ensuring that all equipment is installed in accordance with all local, state and national codes.

Disconnects/Circuit Breaker Panels

TURBO does not provide disconnects or circuit breakers for the electrical devices used in the rake system. Such devices must be furnished by others to comply with local, state and/or federal codes and regulations. The control panel for the rake should be located next to the rake bin. In below freezing storage bins, it may be desirable to locate the control panel in an adjacent room to permit service and maintenance in a warmer environment. Clear viewing of the rake bin from the remote control panel location is still recommended to ensure safe operation of the system.

In most states disconnects are required at each electrical motor. These disconnects are provided and installed by others.

Underwriter's Laboratory (UL) Listing

All TURBO rake control panels are U.L. listed. The label for the electrical panel is located on the electrical backplate located inside the control panel enclosure furnished with the rake.

Lighting

Adequate lighting should be located above and around all sides of the rake bin to permit safe access a to the storage room for service and maintenance of the rake system. Lighting over the interior of the bin should be left on at all times to allow observation of the bin interior through the bin access door or other clear (lexan or equivalent) viewing panels at all times.

Access Doors to Storage Room

For normal day-to-day operation, standard freezer (insulated) doors provide adequate access to the area in which the ice storage bin is located. Service and maintenance of larger components and cleaning may require access by forklifts or other lifting devices. Insulated doors of sufficient width and height must be provided for such access. Components that require removal can be accessed from the front of the rake bin. Adequate space must be provided at the front for forklift access.

Bin Liner Material:

The bin liner is typically constructed of 0.032" Stucco embossed 7/8" corrugated aluminum siding. Other materials, including flat stainless steel, corrugated stainless steel, High-Density Polyethylene plastic, and corrugated galvanized sheets as well as other corrugation thickness can be used. If the thickness of the liner is changed, the clearances between the lifting beams and rake flites will also change. To ensure that sufficient clearance is available with alternate materials, consult TURBO before installation.

The bin liner is attached to the bin structure provided using stainless steel self-tapping screws.

Above Floor Conveyor versus Recessed Floor Screw Conveyor

All rakes require a screw conveyor (auger) at the front of the rake to remove the ice from the rake during delivery (removal) of ice to the final destination. This screw conveyor can be located above the floor or recessed in a pit to make it flush with the floor. The storage capacity of the rake is the same with either the above floor or recessed floor screw conveyor. The advantages and disadvantages of the two methods are described below.

Above Floor Installation

All above floor screw conveyors are mounted with the top of the screw conveyor 17-1/2" from the floor (Figure 3-54). This permits the use of either a 9" or 12" diameter screw conveyor without changes to the dimensional layout of the rake. The location of the door arm brackets and the rake bin door are all based on the 17-1/2" dimension. If a different mounting location is to be used, consult with the factory. With the horizontal "floor" screw conveyor located at this height, the depth of the pit where the floor screw discharges into either an incline or vertical screw conveyor is reduced.

Note:

Discharge of the ice into the top of the incline screw conveyor instead of the side is recommended. This reduces the risk of jamming the screw conveyor at the transition point. A pit is required to provide clearance for the incline screw conveyor under the bottom discharge of the floor screw conveyor. A recess in the floor is normally required with the side discharge incline screw conveyor but a drain is not required. Refer to Figure 3-45.

Incline screw conveyors with a maximum angle of 45° are preferred. Vertical screw conveyors are recommended only if space restrictions do not permit the use of an incline screw conveyor in the delivery system. Since the ice is transported vertically in vertical screw conveyors, high screw speeds are required to move the ice. As a result, the amount of damage to the ice (snow, etc.) is increased.

Assuming the maximum recommended incline angle of 45°, the minimum depth of the pit will vary from 26" for a 9" diameter screw conveyor to 37" minimum for a 12" diameter screw. These dimensions are to be used as a guideline for estimating only. The final dimensions and design of the pit is by others.

For cleaning purposes, a floor drain should be located in the pit. The drain line should be routed to a sewer line or storm drain. Heat tracing of this line may be required.

The rake assembly downward travel is limited to 5" above the floor for sanitation purposes (i.e., the last 5" of ice at the bottom are not usable). Since the top of the screw conveyor is at 17-1/2" above the floor, ice below this level must be conveyed over the top of the conveyor. As the ice level approaches 6" from the floor, more ice falls back into the rake bin. As a result of the extra handling more snow is produced. If a block compactor or other uses for the snow exist, the additional snow may not be a factor in determining the location of the floor screw.

Recessed Floor Screw

Recessed floor screw conveyors are less common due to the cost of the pit required across the entire front of the rake bin in which the screw conveyor is installed. The initial cost of a recessed floor is higher than the standard above floor screw as a result. Refer to Figure 3-45. This pit across the front of the rake will connect to the pit required below the transition for the floor screw and the incline or vertical screw conveyor. Recessed floor screws are typically used for the following reasons:

- a. Less snow is produced during delivery of the last 12" of ice since the ice is not conveyed over the top of the floor screw when the rake reaches the ice level 17-1/2" from the floor. The rake delivery stops when the rake reaches the ice level 5" above the floor. This 5" of "dead" ice is not removed for sanitation reasons.
- b. With the floor screw below the floor level, the floor screw can be extended across the floor without interfering with normal traffic by personnel or other equipment such as forklifts for transporting pallets of ice.

CAUTION

If the floor screw is recessed and heavy traffic will pass over it, a removable steel cover or grate of sufficient strength to support the total weight of the equipment including any load it may be transporting must be securely installed over the pit in which the screw conveyor is located. The screw conveyor itself should not support the load. If possible, designs of this type should be avoided.

General Specifications

All dimensions designating rake sizes are for the interior (ice storage area) of the rakes. Overall dimensions are also listed in Table 3-3. Overall height of the bin structure is obtained by adding four (4) feet to the ice height. To assist in planning requirements, the following general specifications should be used.

For estimating purposes the minimum overall space required for the rake structure is shown in Table 3-3. These dimensions do not allow for service or required electrical clearances. Table 3-2 shows the recommended clearance for electrical enclosures.

As indicated in the table, TURBO recommends the maximum clearance in all cases to provide for service access as well as meet electrical codes.

IMPORTANT

The installing contractor is responsible for ensuring the proper clearance is provided for electrical service and that the installation is in compliance with all local, state, and federal codes.

Table 3-2. Minimum Recommended Control Panel Clearance

| Location on Rake Structure | Clearance, inches |
|---|--------------------------|
| Sides and rear - No live parts. Condition 1 | 36" |
| Side and rear – TURBO recommended | 48" |
| Front | 48-60" (Forklift access) |
| Rear with rear clean out option | 48-60" (Forklift access) |

The National electric Code (NEC) allows 36" and 40" clearance under certain conditions as indicated above. Under Condition 1 of the NEC the clearance can be 36":

Condition 1 – Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating material. Insulated wire or insulated busbars operating at over 300 volts to ground shall not be considered live parts.

Reproduced from the Article 110 of the 1999 National Electric Code handbook.

Table 3-3 Ice Storage Capacities for Standard Models

| Model | Storage Tons of Ice ¹ | Width | Length | Overall Height | Max. Ice height | Floor Space Required, LxWxH ² |
|-------|----------------------------------|--------|--------|----------------|-----------------|--|
| CB-20 | 20 | 10' | 20' | 9'-0" | 5'-0" | 24'-9" x 11'-6" x 9'-0" |
| CB-30 | 30 | 10' | 20' | 11'-10" | 7'-10" | 24'-9" x 11'-6" x 11'-10" |
| CB-38 | 38 | 10' | 20' | 13'-6" | 9'-6" | 24'-9" x 11'-6" x 13'-6" |
| CB-50 | 50 | 10' | 20' | 16'-4" | 12'-4" | 24'-9" x 11'-6" x 16'-4" |
| CB-31 | 31 | 12'-6" | 25' | 9'-0" | 5'-0" | 29'-9" x 14'-6" x 9'-0" |
| CB-49 | 49 | 12'-6" | 25' | 11'-10" | 7'-10" | 29'-9" x 14'-6" x 11'-10" |
| CB-59 | 59 | 12'-6" | 25' | 13'-6" | 9'-6" | 29'-9" x 14'-6" x 13'-6" |
| CB-75 | 75 | 12'-6" | 25' | 16'-4" | 12'-4" | 29'-9" x 14'-6" x 16'-4" |
| CB-87 | 87 | 14'-6" | 25' | 16'-4" | 12'-4" | 29'-9" x 16'-6" x 16'-4" |

¹ Capacity based on ice density of 40 pounds per cubic foot (640 kg/cubic meter) for TURBO fragmented ice:

| | Correction Factor |
|---------------------------------|-------------------|
| TURBO TIG/TIGA R fragmented ice | 0.90 |
| VOGT tube ice (all diameters) | 0.85 |
| Flake ice | 1.05 |

² Includes space required for mounting the hydraulic cylinder and power unit, vertical bin braces (when applicable), control panel, rake bin door opener, and 24" clearance at the front to monitor operation. Additional space is required for service access to the hydraulic unit; most electrical codes require 36-48" clearance in front of the electrical panel. Does not include space for the floor screw drive. Dimensions subject to change without notice. Reference data sheet for installation dimensions.

Table 3-4 Ice Storage Capacity –Tons per Foot

| Length | Ice Capacity Per Foot of Ice Height (tons/ft) | | |
|---------------|--|-------------|-------------|
| | 10' Wide | 12'-6" Wide | 14'-6" Wide |
| 20' | 4.0 | 5.0 | 5.8 |
| 25' | 5.0 | 6.25 | 7.25 |

Notes:

4. All capacities are based on a 40-pound per cubic foot ice density.
5. All dimensions are inside dimensions of the rake bin.

2. DELIVERY INSPECTION

All TURBO CB rakes are factory assembled and tested prior to shipment. The rake is assembled and operated in both the forward and reverse directions to ensure proper clearances and operation; the rake bin door is fully assembled on the floor; and the control panel logic is tested. The rake system is not tested as an assembly (i.e., the rake hoist mechanism, door installation to the steel, lifting mechanism, and the screw conveyor provided by others are not assembled for an ice storage system test). Ice delivery to or from the rake system is not performed at the factory. The testing that is done ensures shipment of a mechanically sound piece of equipment.

Inspect the rake system components upon arrival at the installation for any damage resulting from shipment. Report any damage found or suspected to the transportation company immediately so that an authorized agent can examine the shipment, determine the extent of the damage and take the necessary steps to rectify the claim without costly delays. Since equipment is shipped FOB, Louisville, KY, the consignee must initiate the claim. TURBO does not have a legal basis on which to file a claim since ownership of the equipment is transferred from TURBO to the consignee when the trucking company accepts the shipment at Louisville, KY or other designated shipping locations. TURBO should be notified of any claims made.

TURBO CB rakes are shipped by common carrier. The consignee may choose to pick up the equipment at the point of manufacture or specify the means of transportation or the carrier. Method of shipment should be specified at the time the order for the equipment is placed to ensure that best rates and delivery are obtained.

Delivery Inspection Checklist

1. Locate the packing slip provided with the equipment. This will identify the number of pieces and the contents of each box, crate or container shipped. An example of the packing slip is shown in Figure 3-1 at the beginning of the Installation section.
2. Verify that all the pieces have been received. Inspect all boxes and crates for damage.
 - a. Check the skid with rake girders, lifting beams, cross beams and cross brace assemblies.
 - b. Check the skid with rake flite assemblies.
 - c. Check the rake I-beam assemblies.
 - d. Check the rake drive and idler shaft assemblies.
 - e. Check the rake drive assembly.
 - e. Check the skid with the rake guides.
 - f. Check the skid with rake bin door assembly.

Loose Boxes and Crates

1. Open all crates or boxes shipped with equipment.
2. Verify all loose parts and crates versus components listed on the packing slip.
3. Check all components, boxes or crates for damage. The rake drive chain, pulleys and all hardware are located in wood crates.

Read Safety Section before installing and operating equipment

4. Locate the box containing the control panel and check it for damage. Additional copies of the this Manual shipped in the control panel

The above checklist is for a quick reference. The packing slip should be used for the actual inspection and acceptance of the shipment.

Warning Labels

Check that all warning labels are in place (refer to section 2 – Safety) and that an installation manual is available at the job site.

If labels are not in place or the manual is not available at the job site, contact TURBO immediately:

**Vogt Ice, LLC
Turbo Refrigerating, LLC
1000 West Ormsby, Suite 19
Louisville, KY 40210
Phone: 9502-635-3500
Fax: 502-635-3024**

IMPORTANT

The installation manual must be at the job site before installation of the equipment begins. Read the Safety Section before proceeding.

Handling of Rake Components

All components of the rake can be moved and assembled with a standard 4,000 pound capacity forklift with a sixteen (16) foot vertical lift. A small crane or overhead hoist may be required to position the rake bin door. The crane provided by the contractor erecting the bin structure can be used to hoist the door into position. Rake installations with structure height exceeding sixteen (16) feet will required a forklift with a higher vertical lift capability.

Table 3-7 lists some typical component weights. These weights will vary depending on the size of the rake. Use the weights listed below as a guide only. Test the weight and weight distribution before lifting, hoisting, or transporting a component to ensure it can be safely lifted or moved by the forklift or other devices being used.

Table 3-5 Estimated Weights for CB Rake and Structures

| Rake Size | Models | Number of Horizontal Rows | Rake Assembly Weight, pounds | Structure Weight, pounds ² | Total Weight pounds ¹ |
|---------------------|---------------|--------------------------------------|---|--|---|
| 10' x 20' | CB-20 | 2 | 3,000 | 4,550 | 7,550 |
| | CB-30 | 3 | 3,000 | 5,600 | 8,600 |
| | CB-38 | 3 | 3,000 | 6,400 | 9,400 |
| | CB-50 | 4 | 3,000 | 7,320 | 10,320 |
| 12'-6" x 25' | CB-31 | 2 | 3,600 | 5,590 | 9,190 |
| | CB-49 | 3 | 3,600 | 6,700 | 10,300 |
| | CB-59 | 3 | 3,600 | 7,800 | 11,400 |
| | CB-75 | 4 | 3,600 | 8,840 | 12,440 |
| 14'-6" x 25' | CB-87 | 4 | 3,950 | 9,050 | 13,000 |

Notes:

1. All weights are estimated based on the use of 2" square structural tubing, 8" by 31 pound per foot I-beams for the front upper and lower structural members, and 0.032" corrugated aluminum siding.
2. Structure weight includes sides and rear bin structure, siding, rake guides, bin door and retainer wall, all pulleys, rake lifting mechanism, and hydraulic package.
3. Total weight does not include product load (ice) in bin. Weights are for empty bin.

TURBO Nameplate

Locate the TURBO nameplate on the door of the electrical control panel supplied with the rake and record the information for future reference.

The TURBO serial number (located on the control panel nameplate) should be referenced in all inquiries to TURBO.

Equipment

Check the equipment received versus the purchase order and TURBO sales acknowledgment form. Report any discrepancies to TURBO immediately.

3. BIN STRUCTURE INSTALLATION

The bin structures are marked left, right, and rear. The lower sections are marked with the number one (1), the second row number (2), if used third row number is (3), and fourth row number (4). Bolt in the lower I-beam to the front of the lower left hand and right hand bin structures using the lower I-beam hardware. Refer to Figure 3-3.

Next assemble the remaining lower sections using the bin structure hardware.

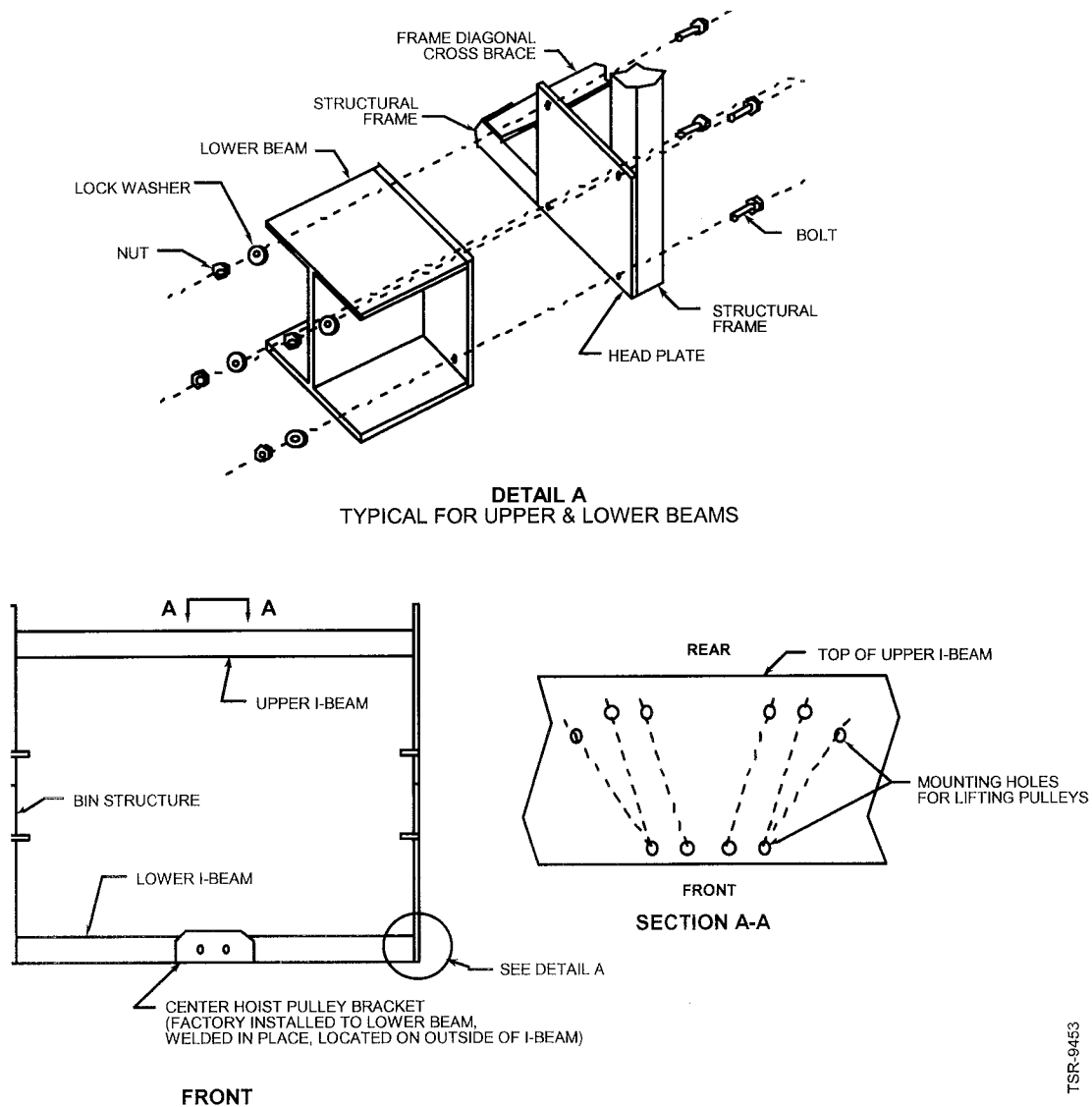


Figure 3-3 Upper & Lower I-Beam Installation

Carefully lift the next sections of the structure into place using a fork lift and crane capable of safely lifting each section of the bin structure and secure using the hardware provided. Refer to Figure 3-4 for the number of section rows per model and Figure 3-7 for hardware requirements.

Read Safety Section before installing and operating equipment

The top sections of the bin structure also have mounting plates located on the inside front of the left and right hand side structure. To assemble the top section on all rakes assemble the sides and rear first and then mount the upper I-beam between the two side structures using the hardware provided. Reference Figure 3-3 above for the orientation of the holes in the upper beam. The holes in the top for the hoist pulley brackets that will be installed later should be on top as shown.

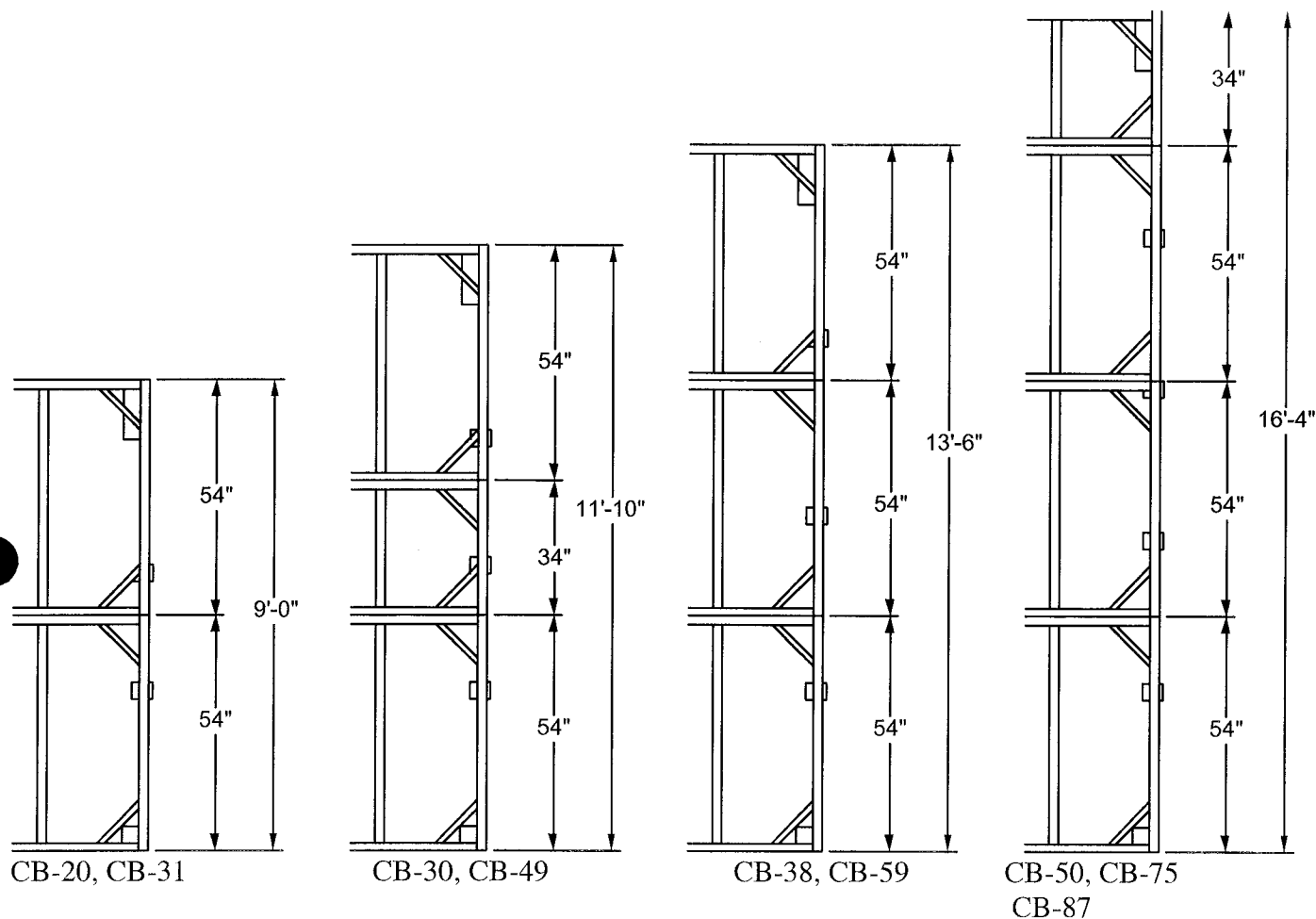


Figure 3-4 CB Rake Models Structure Configuration

After all of the rows have been assembled, and the upper and lower I-beams are in place, install the upper and lower horizontal structure braces using the four to five braces and brace hardware provided.

Horizontal Bin Braces

Each of the horizontal braces consists of a 2" by 2" tube with flanges on both ends. Two braces are provided for the top and two for the bottom of the bin structure to stabilize the center of the bin structure at the bottom and top. Refer to the rake isometric drawing enclosed (216-XXXX-XX) and Figure 3-5.

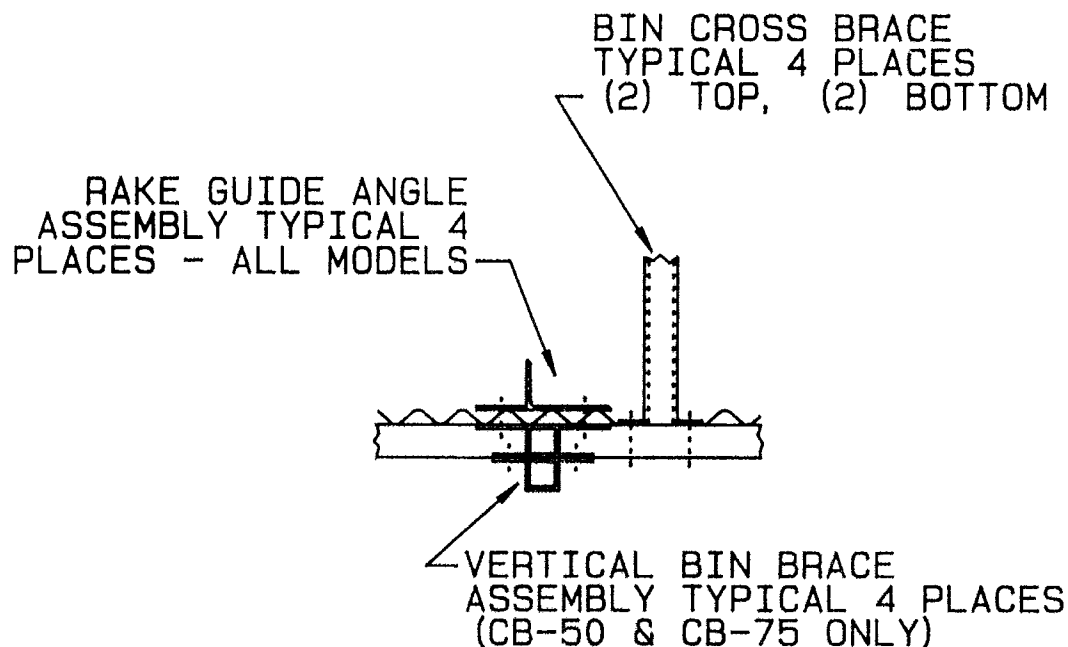


Figure 3-5 Horizontal Bin Brace Installation

Diagonal Corner Brace Installation

Next install the corner diagonal braces between the upper and lower I-beams and the bin structure. These braces provide additional stability to the bin structure at the front of the rake. Install the braces as shown in Figure 3-6. When tightening the corner braces check the front structure for squareness and level.

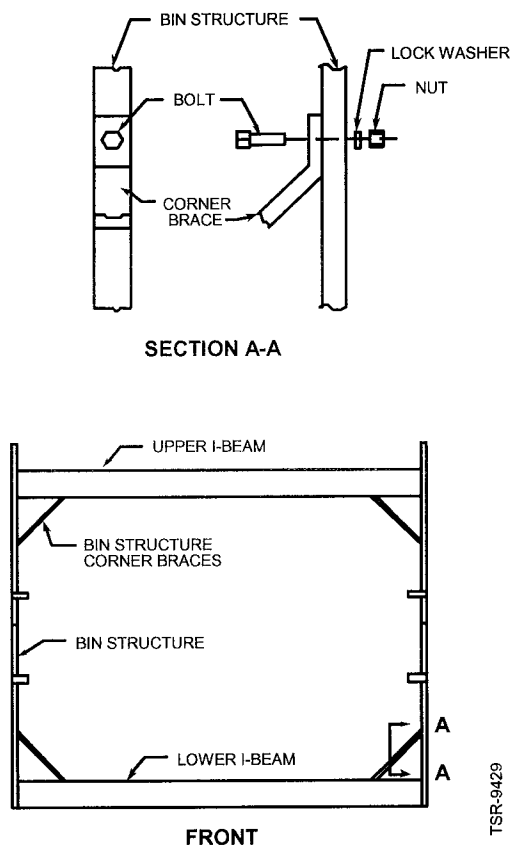


Figure 3-6 Corner Diagonal Brace Installation

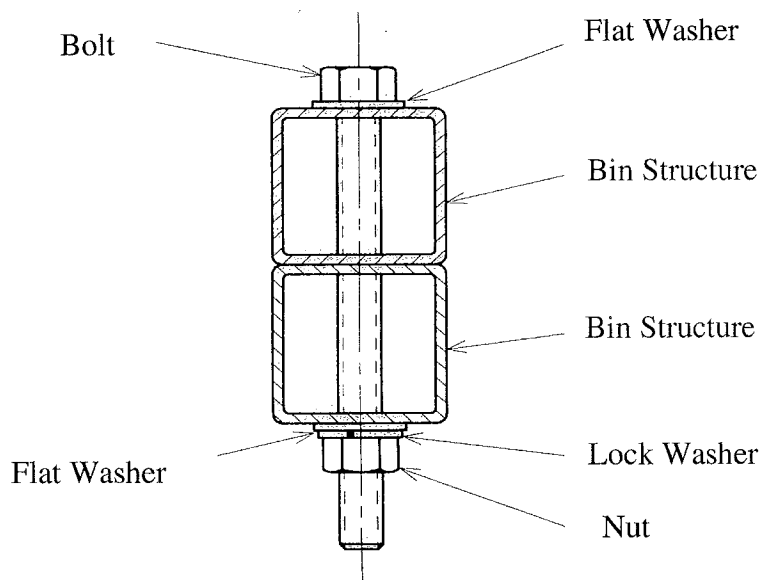


Figure 3-7 Typical Section of Bolted Structures

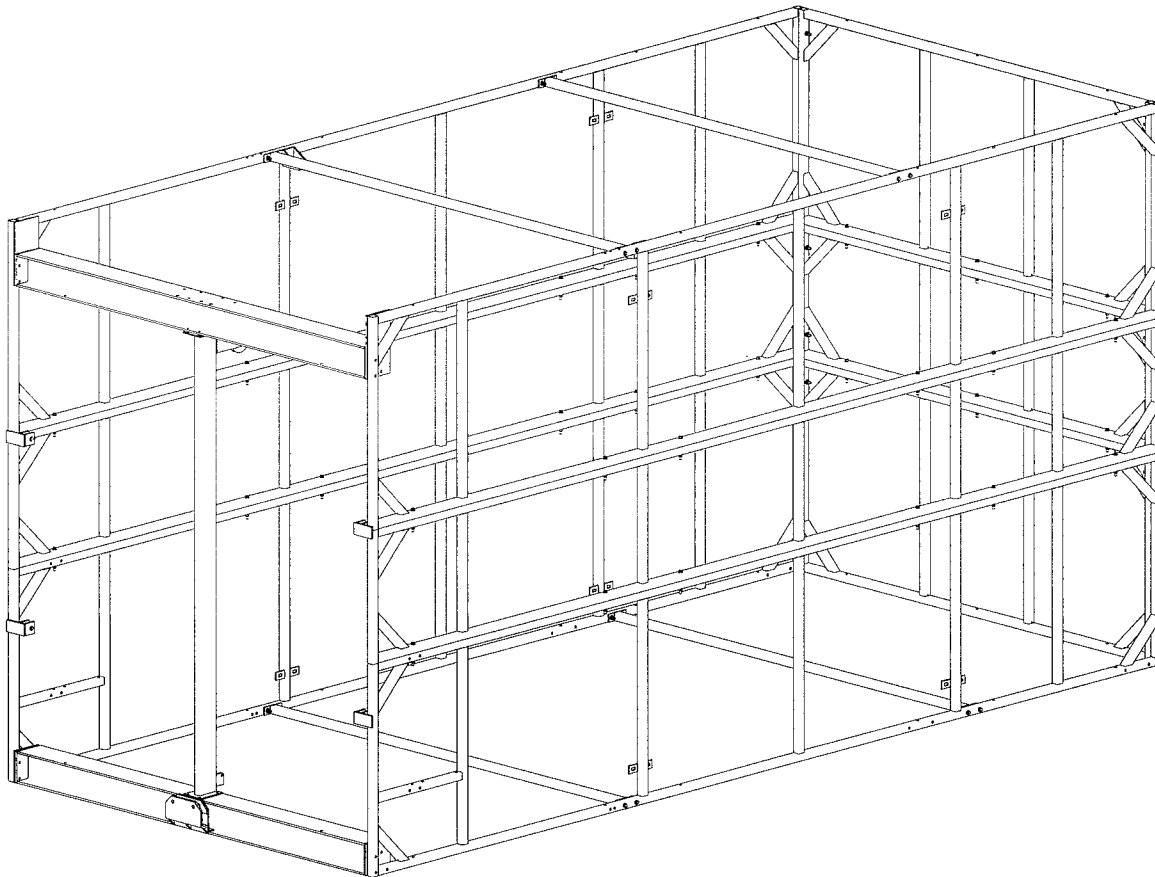


Figure 3-8 Typical Bolted Structure

RAKE HOIST PULLEY INSTALLATION

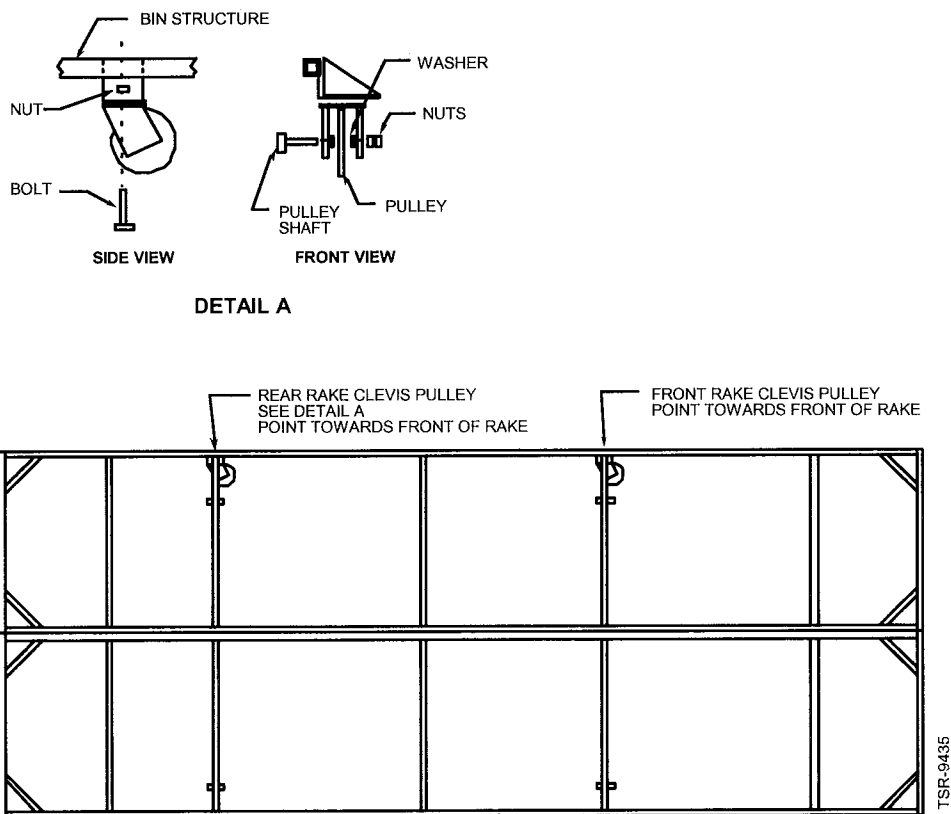
After the rake structure erection is completed, the pulley brackets for the rake hoist pulleys are bolted to the two (2) brackets located on each side of the structure at each of the four lifting points. Two pulley brackets are bolted to each side. Refer to drawing 216-XXXX-XX. The brackets provided by TURBO are hot-dip galvanized.

In addition to the pulley brackets located above the rake lifting beams, four (4) pulleys are bolted to the front upper horizontal beam. All eight pulleys are the same.

Lifting Point Pulley Mounting

As indicated in Figure 3-19, the pulley over the lifting beams must be rotated about the pivot point indicated to obtain the proper alignment with the pulley brackets located upper beam at the front of the steel.

Install the clevis pulley/pulley bracket assembly to the pad welded at the top of the rake structure. Each pulley assembly should point toward the front of the rake as shown in Figure 3-12. The bolt that attaches the bracket to the structure should be secured but not tightened.



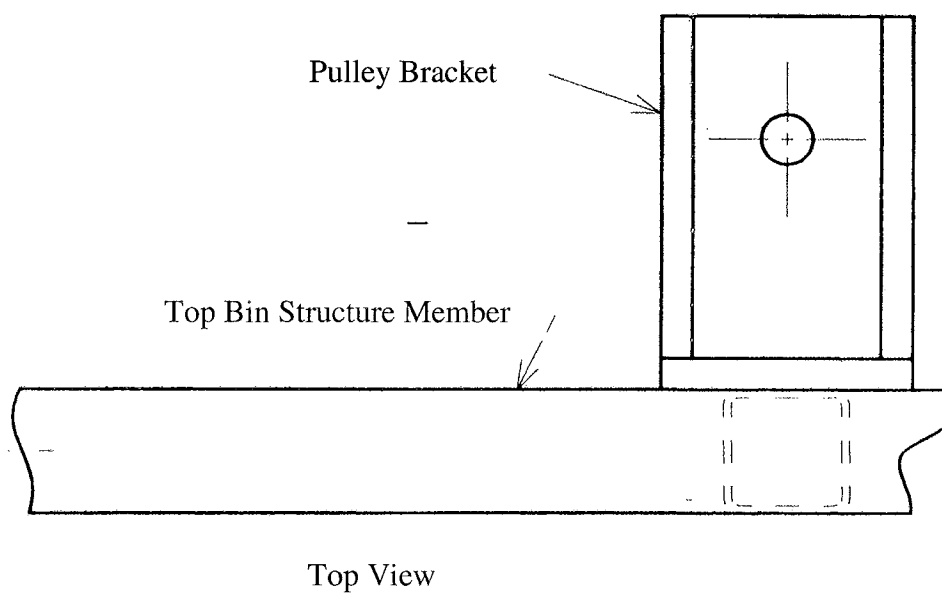


Figure 3-10 Typical Pulley Bracket

5. RAKE BIN LINER INSTALLATION

Before the rake guide angles can be completed, the bin liner must be in place. It is not necessary to install the entire bin liner at this time. However, the bin liner must be in place at the four lifting points. The installation instructions below will detail installation of the entire bin liner including the area around the rake bin door and floor screw conveyor. It is typically easier to install the liner at the front after the floor screw conveyor has been installed. The liner must be trimmed to fit around the screw conveyor.

The bin liner is installed on the interior of the bin structure and extends approximately 13 inches above the ice height (i.e., it is not necessary to install the liner to the top of the steel). Corrugated aluminum is standard bin liner. Other materials such as stainless steel (flat or corrugated), PVC, polypropylene, or even marine grade plywood can also be used. The bin liner is installed on the rear and both sides of the rake bin structure. A liner is not required at the front of the rake bin. A rake bin door is provided with all rakes to complete the interior bin structure. The bin liner installation is as follows:

Corrugated Liner Installation

1. Starting at the center of the rear bin structure, place a piece of corrugated aluminum siding upright with the centerline of the sheet on the same centerline as the rake structural member. Attach the siding with weather-tight self-tapping screws. At this point, only insert enough screws to hold the sheet in position. The remainder of the screws will be installed after the installation of the liner is complete and all the required cutouts have been made.
2. Continue placing the corrugated sheet along the bottom row of the structure. Overlap two (2) corrugations on each sheet. At the corner of the bin structure, again overlap two (2) corrugations and then wrap the sheet into the corner to form a 90-degree bend. Attach the sheet to the rear and side framing channels as described above.

Note:

At this point in the assembly, only the bottom row will be installed.

3. Continue to install the sheets on both sides and the rear. The last two sheets on the front sides should not be installed at this time. These sheets will be installed after the floor screw conveyor has been installed.
4. Repeat steps #3 through #8 for the second and third row (if required). The overlap between the rows of siding should be a minimum of 3". Depending on the height of the rake structure, the overlap of the top row of siding may be greater than the 3" recommended above. In some cases, the overlap may be such that half-sheets of corrugated siding can be used.
5. Add all attachment screws to secure the siding permanently.

Read Safety Section before installing and operating equipment

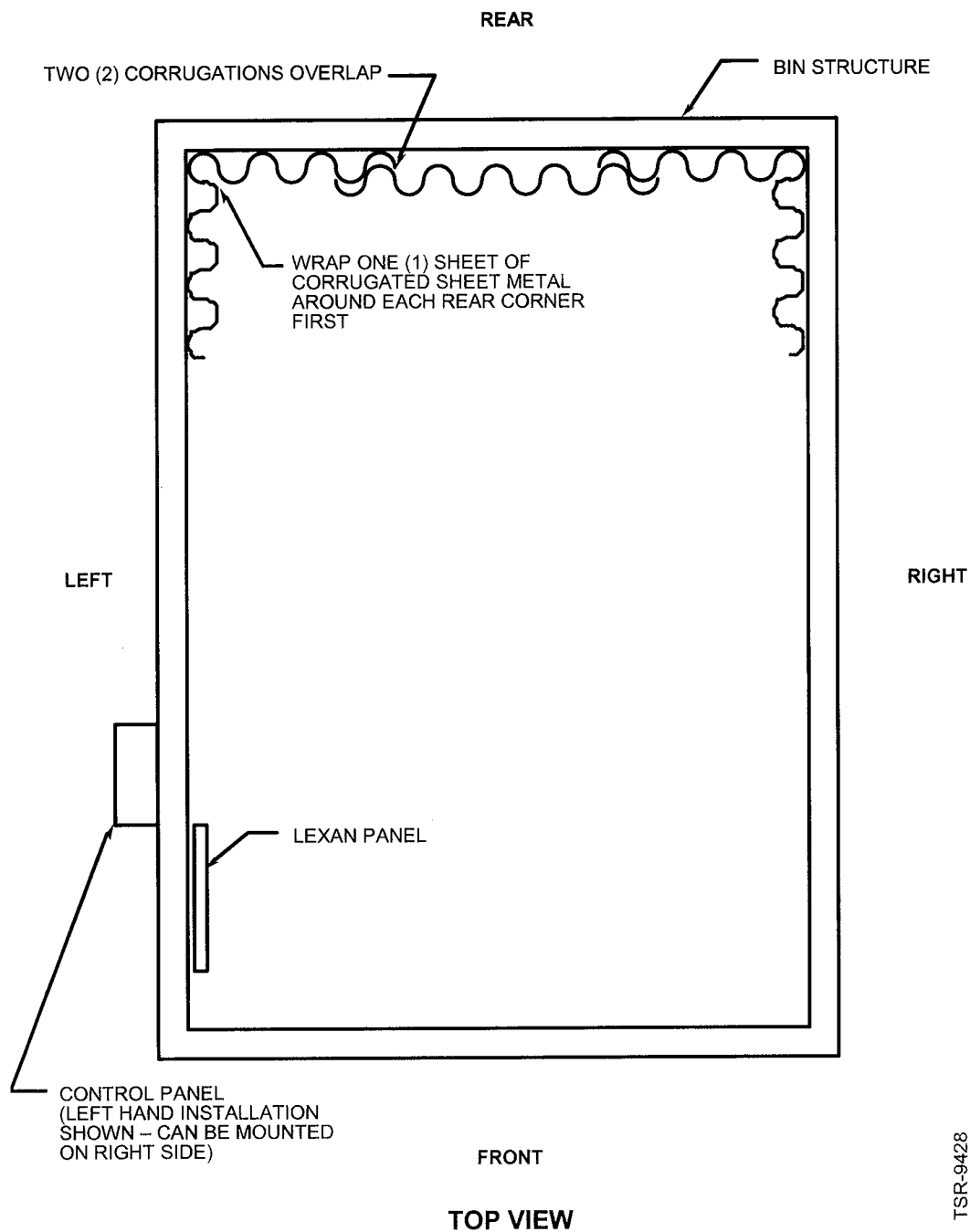


Figure 3-11 Corrugated Sheet Metal Installation

HDPE Liner Installation

Unlike corrugated lining the HDPE liners are cut to size and have a specific layout. The drawings in the at the end of this section show layouts for a particular size bin. If the bin is not a standard size contact the factory for additional information. Refer to Figure 3-12 for HDPE liner installation.

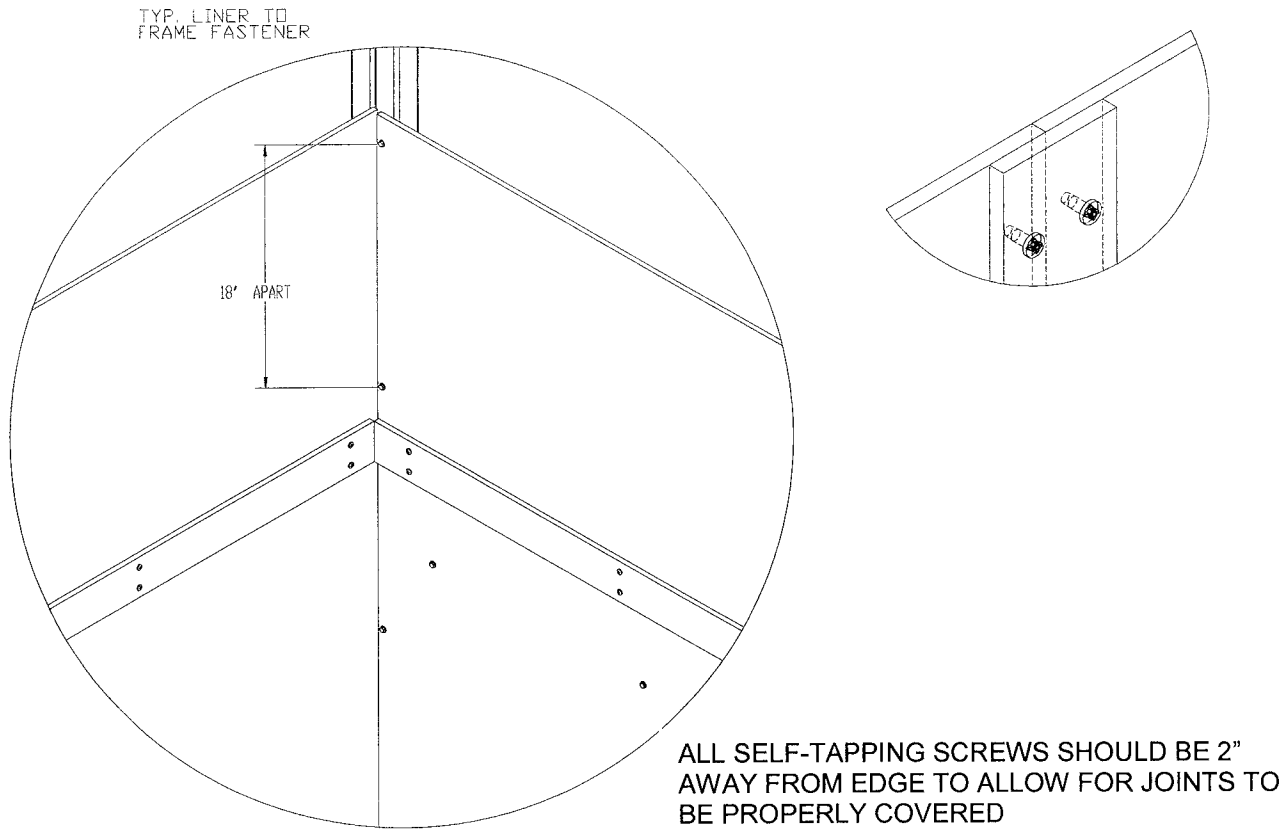


Figure 3-12 HDPE Liner Installation

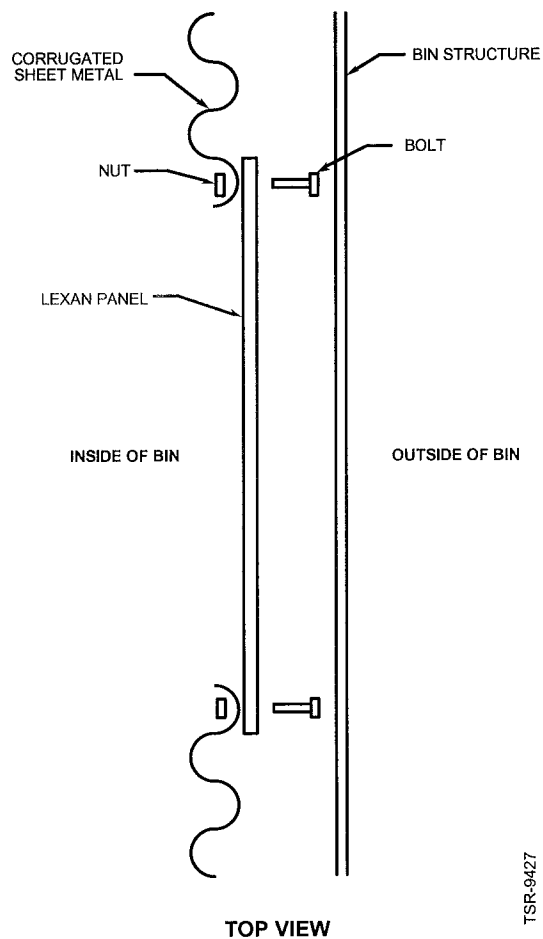
Lexan Panel Installation

A lexan panel is furnished for viewing the rake while it is operating. Refer to Figure 2-4 in section 2 ... Safety.

Note:

The lexan panel can be mounted on the left-hand side or right hand side. It should be next to the door and on the same side as the control panel.

Install the lexan panel near the electrical control panel. Bolt the lexan panel under the corrugated sheet metal. Use tin snips to notch the corrugated sheet metal where needed. Refer to Figure 3-13.



**Figure 3-13 Lexan
Panel Installation**

**Figure 3-14A
CB 30 HDPE
Bin Liner**

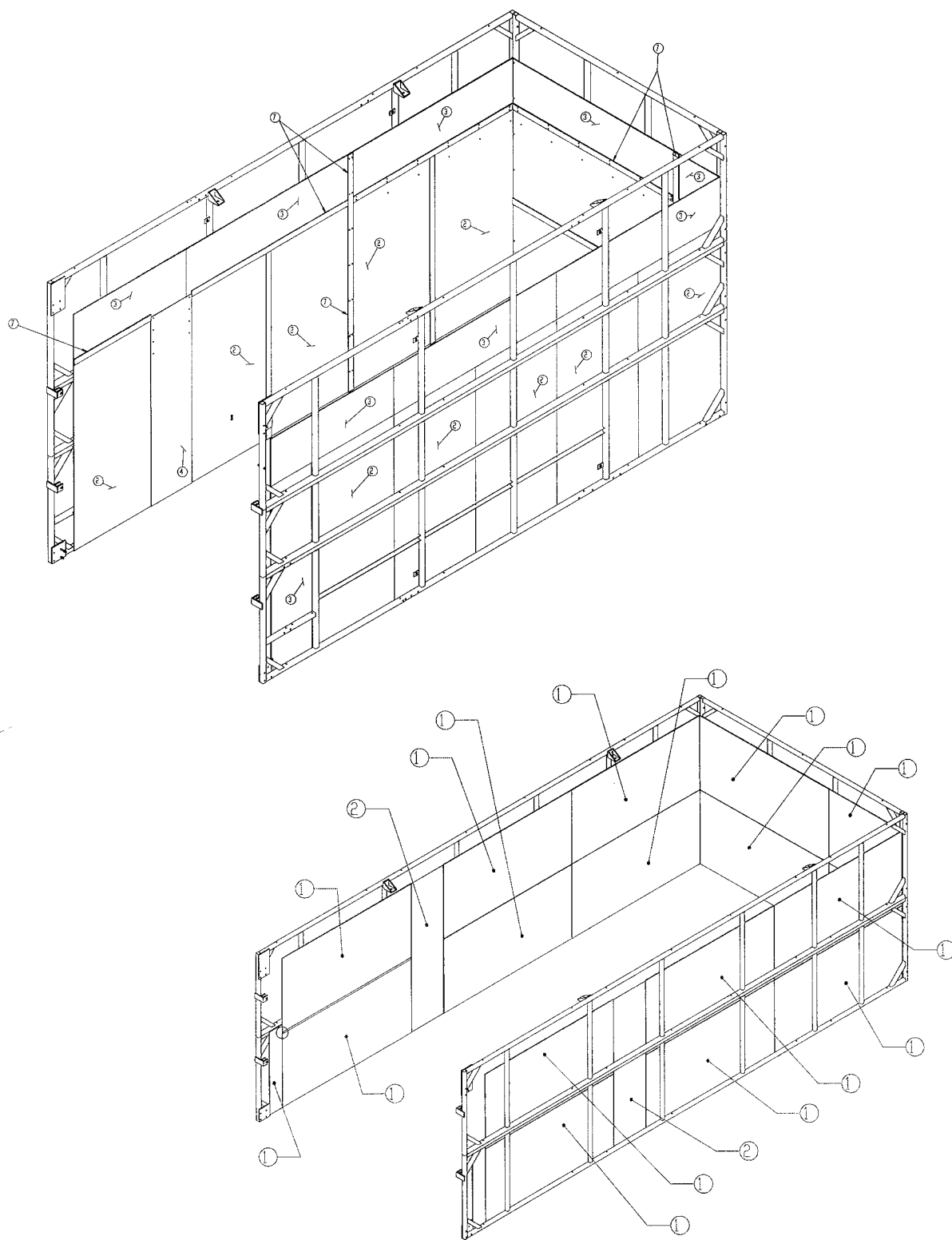


Figure 3-14 A HDPE Liner (CB 30 and 31)

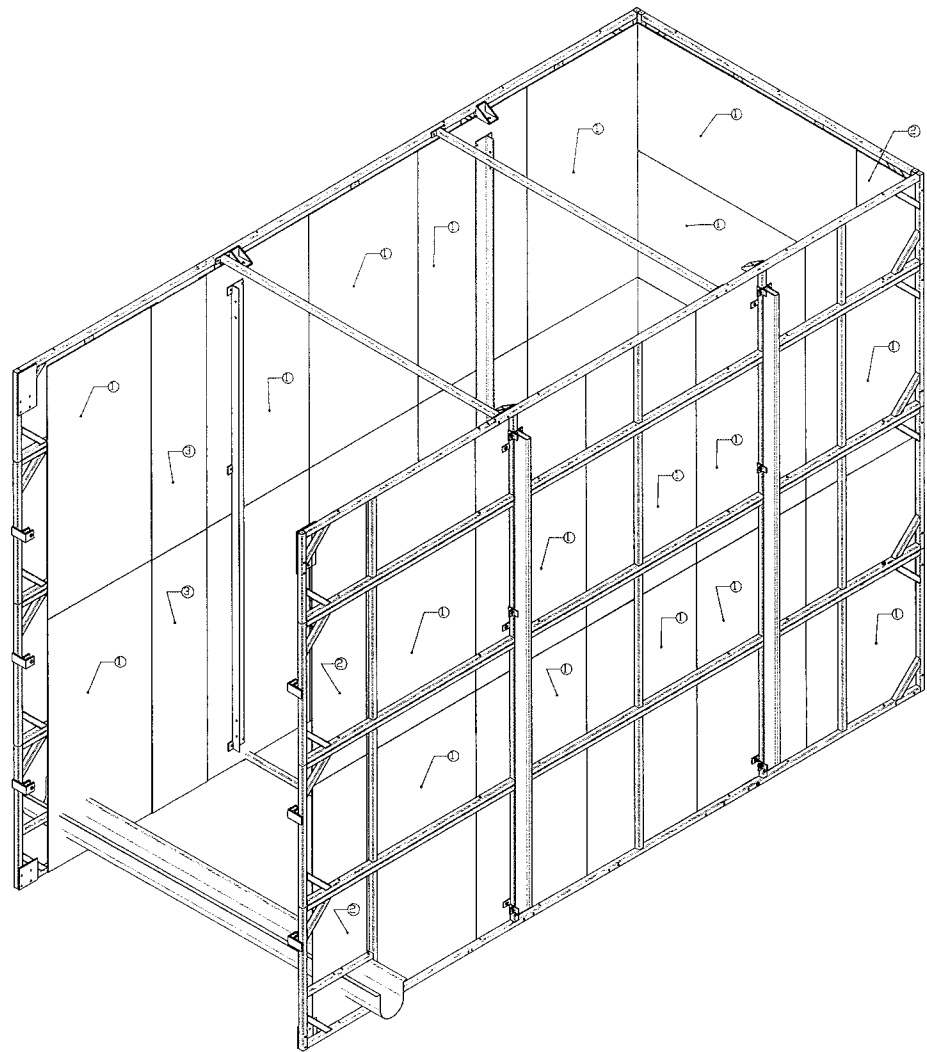


Figure 3-14 B HDPE Liner (CB 50)

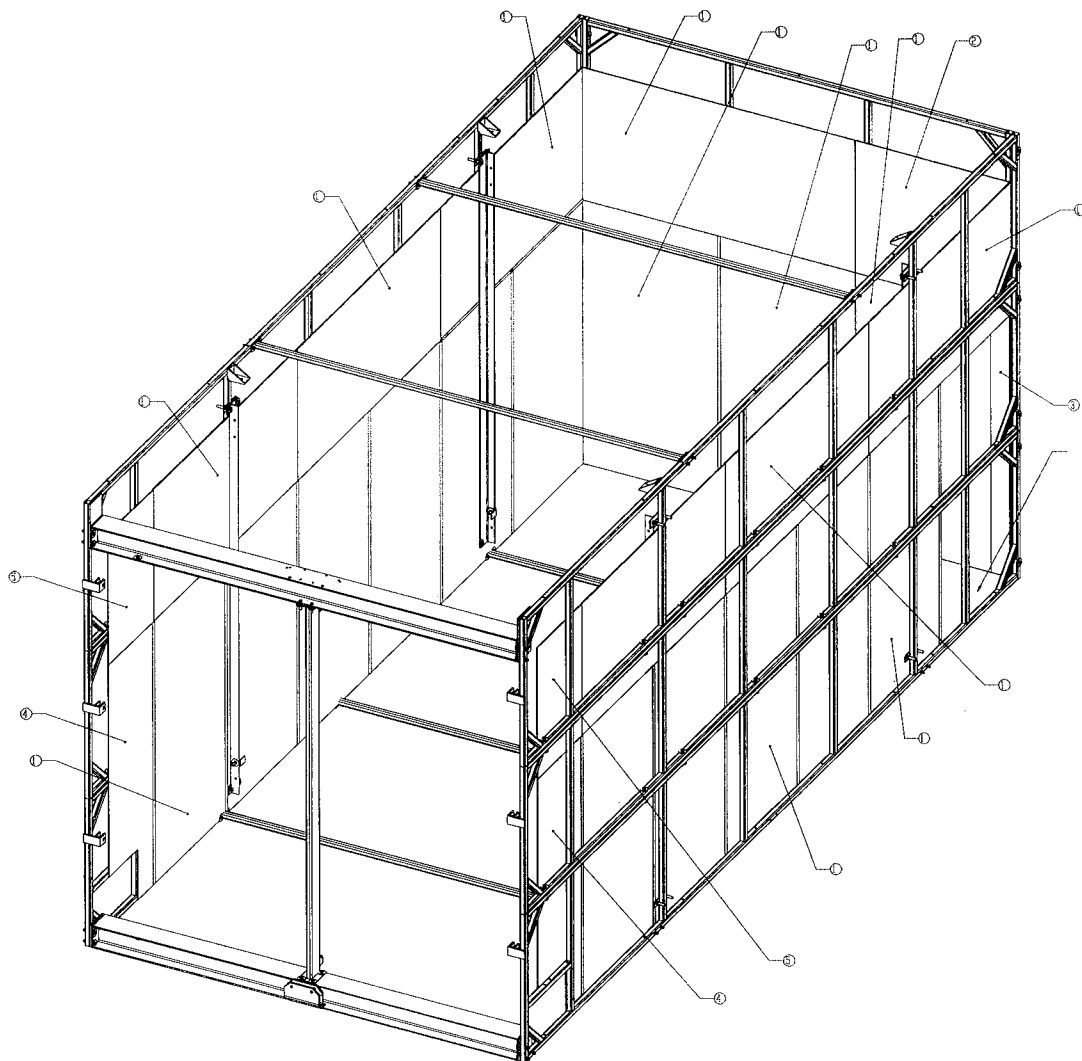


Figure 3-14 C HDPE Liner (CB 59)

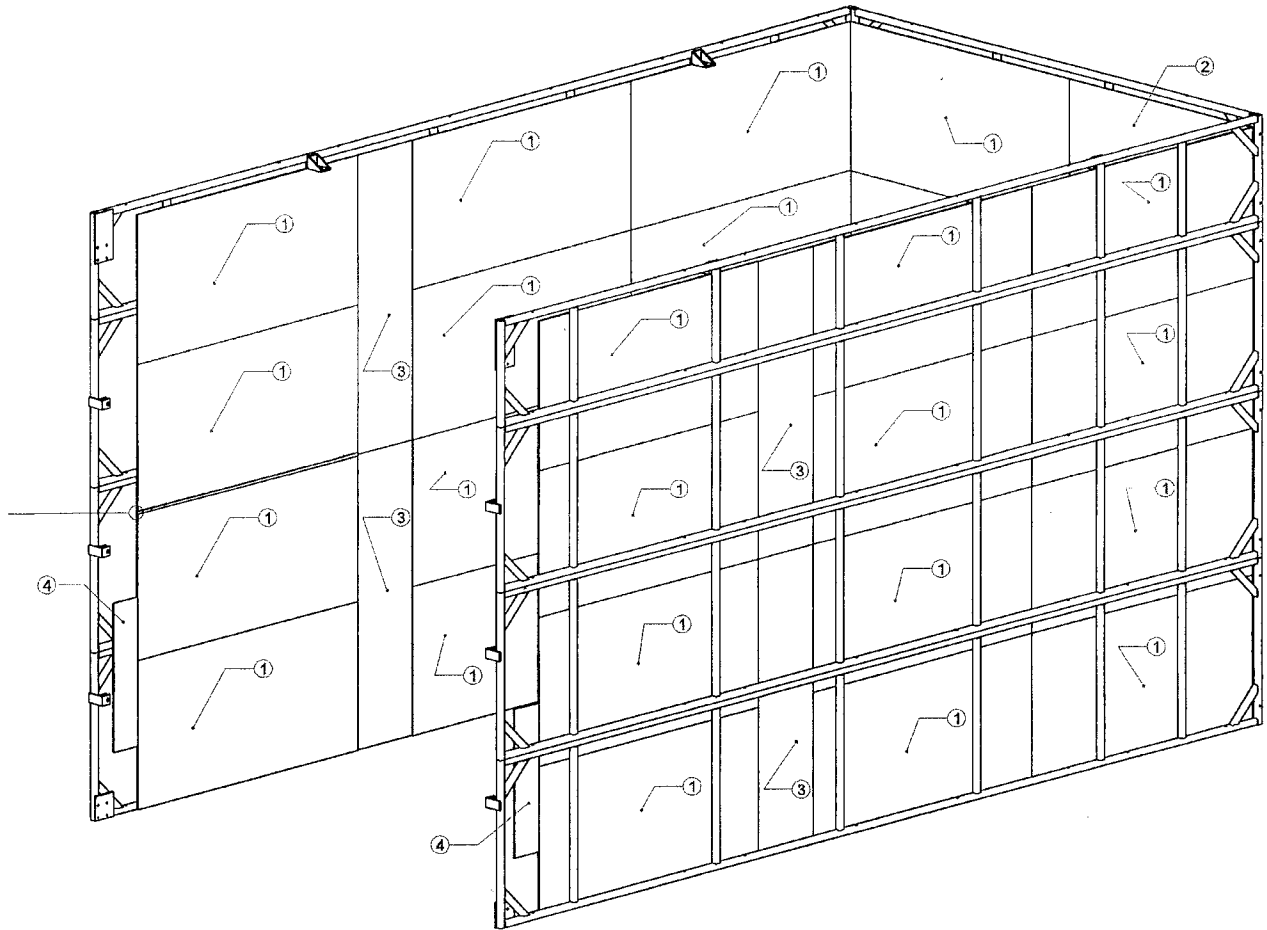


Figure 3-14 D HDPE Liner (CB 87)

5. RAKE GUIDE INSTALLATION

Place a rake guide angle at each of the four (4) lifting points refer to Figure 3-18. There will be two left-hand and two right-hand rake guides. One of each will go on both sides. The rake guides will be located directly below the pulley mounting bracket located on the upper side bin structure. Tabs are provided on the bin structure to attach the rake guides to the structure. The rake guides at the front will be mounted with the flange on the side closest to the bin door (front) of the rake. The rear guides will be opposite that orientation with the flange on the side closest to the rear wall of the rake. The rake guide angles form a box and prevents the rake from getting out of position when operating.

A 7/8" long round standoff /spacer is provided to provide clearance for the standard bin structure walls. A section of the siding material must be installed at each of the rake guide locations at this time or the rake guides can be removed to install the bin liner later in the installation process.

NOTE:

In most cases it is more convenient to install the bin liner prior to this operation. However, access to the bin interior is more limited with the liner in place and it can require additional time to assembly the rake inside the bin. Damage to the bin liner during installation is also a risk if the complete bin liner is installed at this time.

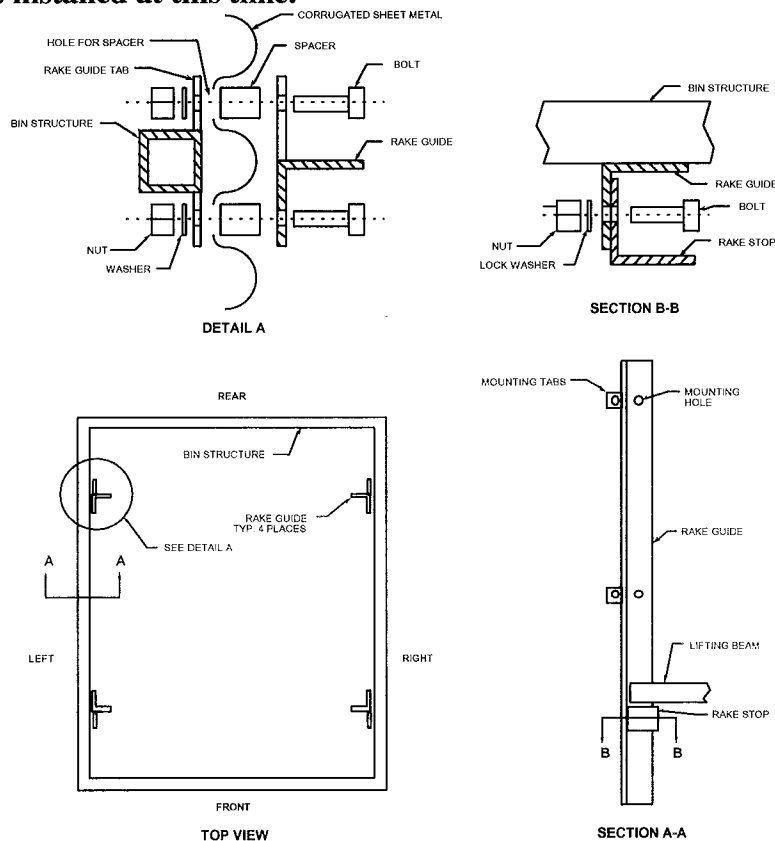


Figure 3-15 Rake Guide/Rake Stop Installation

Cut a hole in the corrugated sheet metal to clear each spacer.

Read Safety Section before installing and operating equipment

Before tightening hardware, check the rake guide angle clearance and vertical alignment front-to-back and side-to-side with the rake lifting beam. Use a level to ensure that the rake guide angle is parallel to the travel of the rake.

Note:

During initial operation, the clearance between the lifting beam and guide angles should be checked over the entire travel of the rake from the bottom to the top. If the rake guides are not parallel from top to bottom at all four corners the rake lifting beam and guide angles could interfere with each other causing a restriction in the rake travel.

The rake stops are a piece of hot-dip galvanized angle that bolts to the bottom of the rake guide angle to keep the rake from going down to the floor. There are two sets of holes on the guide angles for the “rake stop”. The rake guide stop angle will be installed later in the installation process. Use the upper set of holes if the floor screw is above the floor and the lower set if the floor screw is recessed.

NOTE:

The lower holes can also be used on installations with the floor screw located above the floor. This will allow the removal of additional ice from the bottom of the bin but the amount of snow produced will increase since the rake is below the top of the screw conveyor.

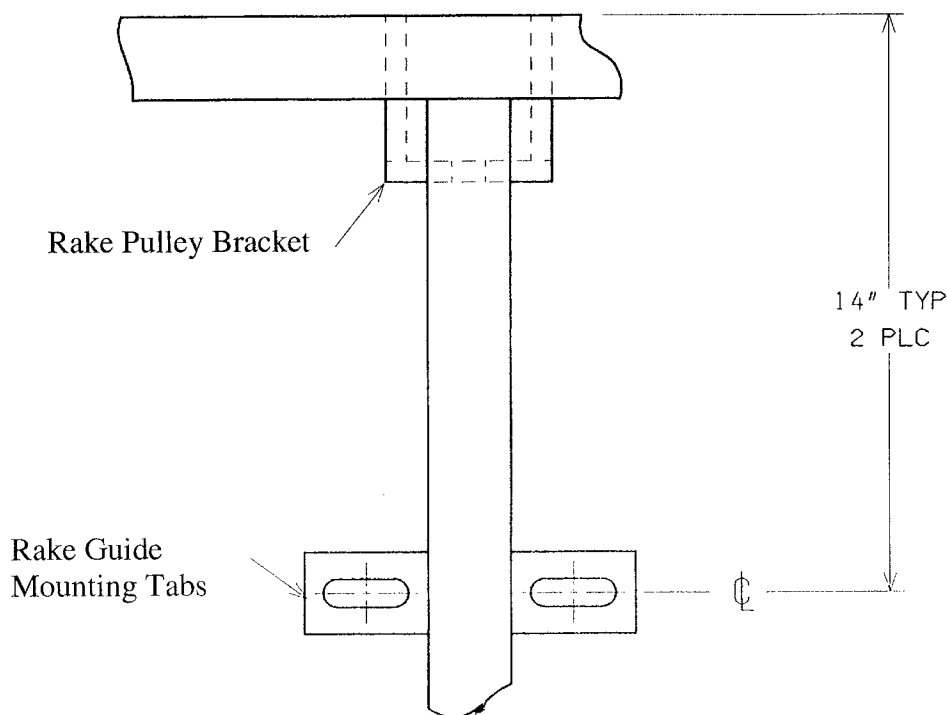


Figure 3-16 Typical Upper Rake Guide Mounting Tabs

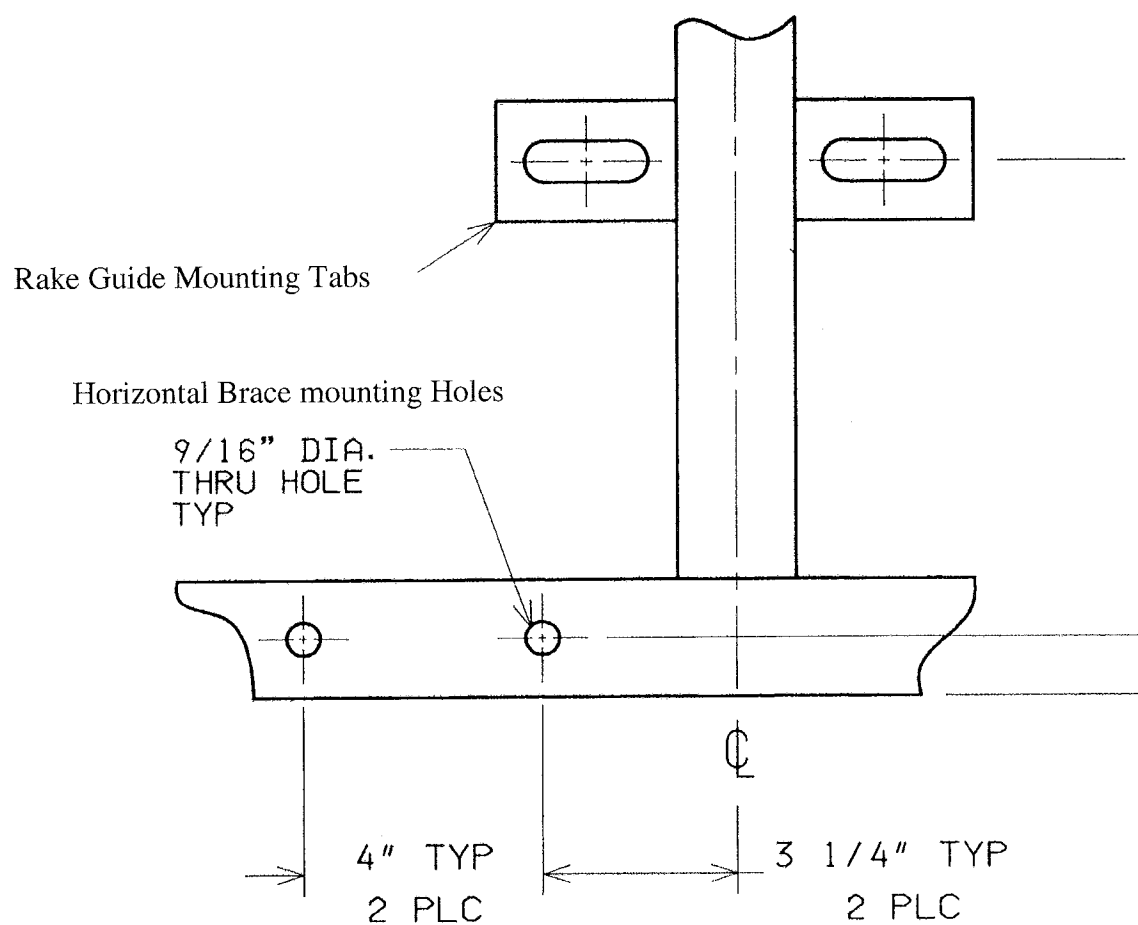


Figure 3-17 Typical Lower Rake Guide Mounting Tabs

6. RAKE ASSEMBLY

Note:

Pay close attention to factory match marks. Match marks are on pieces to help reassemble them. Match marks may be numbers or letters that are either stenciled on the matching parts or inscribed on the pieces with weld bead before they are hot-dip galvanized. When assembling the rake you can determine if the parts are properly located by verifying the match marks. If a structural member with the number "12" on it is bolted to another structural member, the second structural member should also have the number "12" on it at the attachment point.

Lifting Beam Installation

Install the lifting beams using the lifting beam hardware. Do not tighten the bolts. Refer to Figure 3-18. Use a framing square to ensure that the girders are perpendicular to the channels and lifting beams.

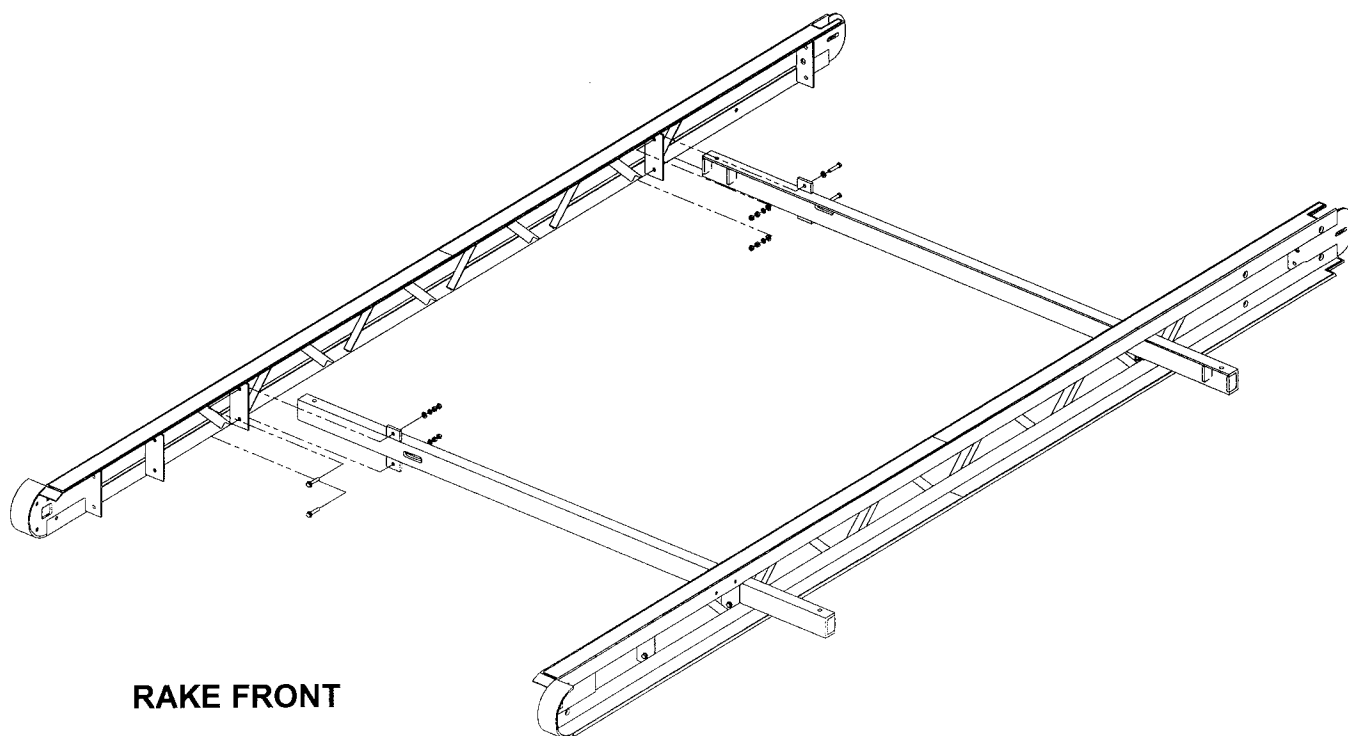


Figure 3-18 Lifting Beam Installation

Idler and Drive Assembly Installation

Two to four 2-ton floor jacks are required to elevate and block the girder/lifting beam assembly. Metal stands or wood blocks with a total height of at least 15" are also required. If one end is raised at a time, only two floor jacks are required. If both ends of the rake are to be elevated at the same time, four floor jacks are required. The procedure described below is for elevating one end at a time. If both ends are elevated at the same time, perform the same task on both ends of the rake.

1. Place a floor jack under the lifting beam next to the girder section on both sides of the rake.
2. Jack the rake up at least six (6) inches.
3. After the final height is reached to clear the rake stop, place the metal stands or large wood blocks under the rake and lower the rake until it is securely supported by the stands or blocks instead of the floor jacks.
4. Lower rake onto stops and remove floor jacks.
5. Move the drive assembly into place (Refer to Figure 3-19)
6. Position one jack on each side of the drive assembly and jack into position
7. Using the appropriate hardware secure the drive assembly
8. Repeat steps 6 and 7 for the idler assembly
9. Place a level on the drive shaft to assure it is level. Adjust as necessary

WARNING

The idler and drive assemblies are heavy. Use adequate manpower for lifting. Failure to carefully follow these instructions could result in permanent injury or loss of life.

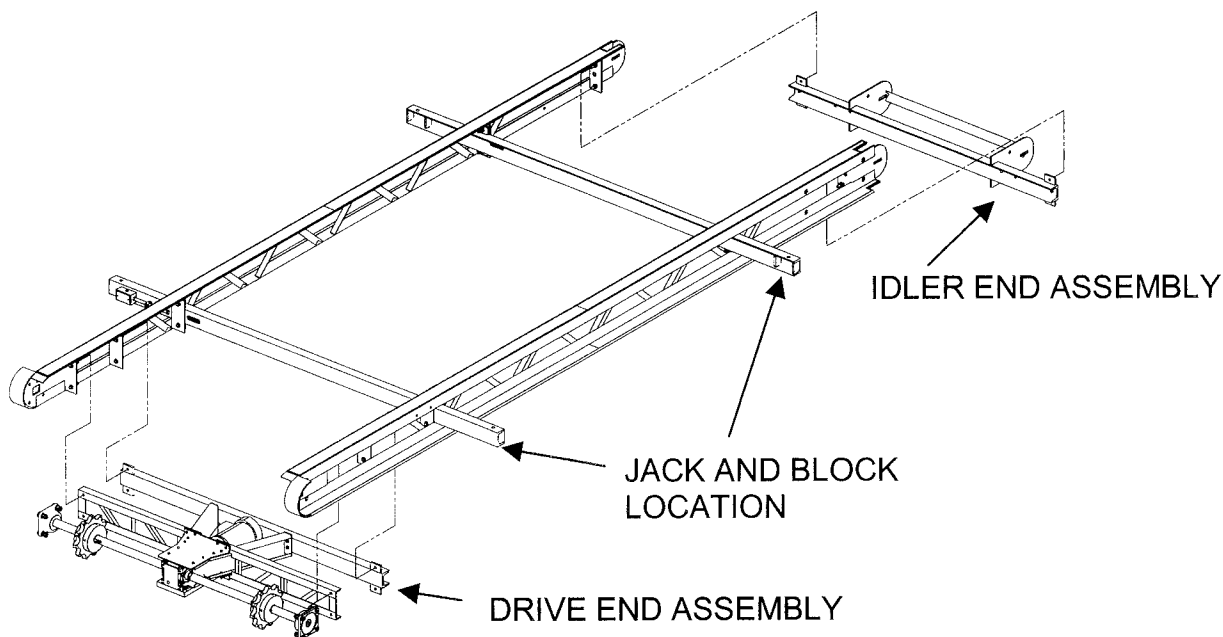


Figure 3-19 Drive and Idler End Installation

Cross Bracing Rod Installation

Install the cross bracing rods using the half-moon bevel washer and rod hardware.

Carefully adjust the rods so that the beams measure to within 1/8 inch diagonally from corner to corner. Refer to Figure 3-20.

Tighten all bolts and recheck diagonal square.

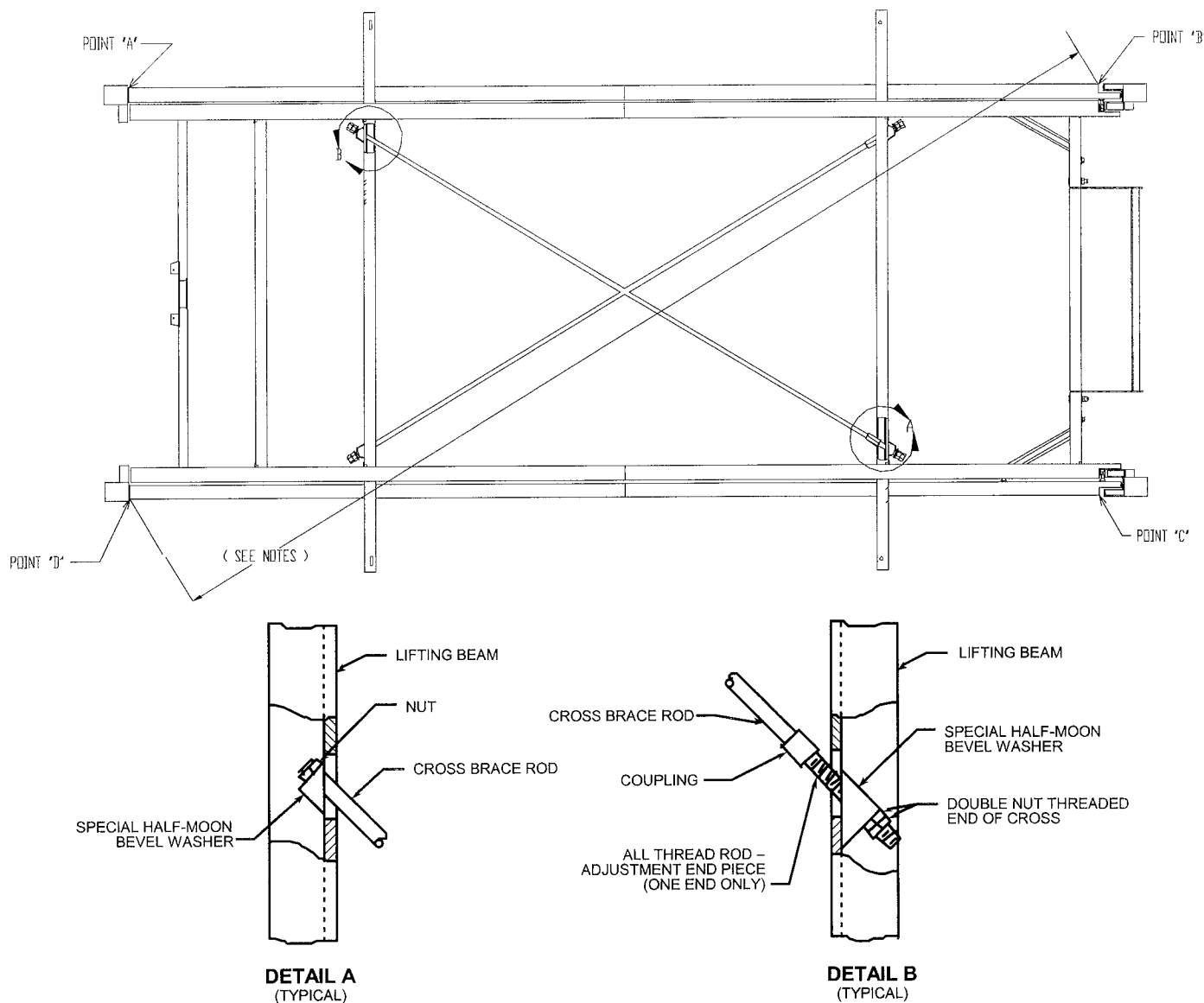


Figure 3-20 Cross Bracing Rod Installation

Read Safety Section before installing and operating equipment

Confirm the drive shaft and idler shaft sprockets the same distance from the girders on each side. Refer to Figure 3-21. Place a level on the shaft to assure it is level. Adjust the sprockets as necessary.

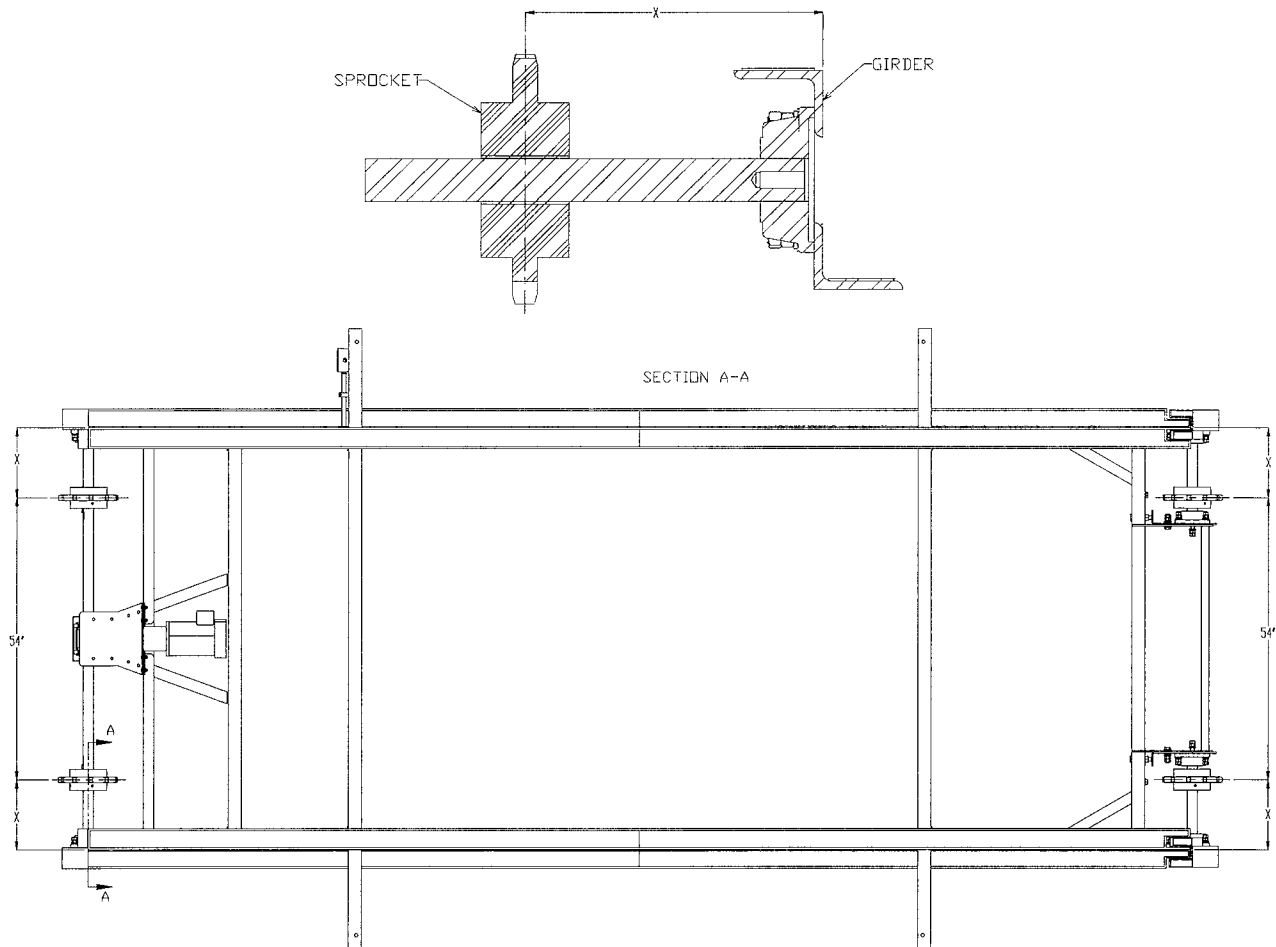


Figure 3-21 Sprocket Measurement

The distance from center to center of the sprockets should be fifty-four (54) inches as shown in Figure 3-21. The sprockets and bushings are pre-assembled and tightened at the factory. Check when installing and after 10 hours of operation.

IMPORTANT

Keep centerline sprocket measurement correct. Keep sprocket bushings tight to prevent sprockets from moving out of place during operation. For proper wear and operation, the X dimension for all four (4) locations and the fifty-four (54) inch center-to-center distance must be maintained ($\pm 1/8$ ").

Electrical Conduit Installation

After the rake motor drive assembly is installed, the three-phase electrical connections will be made at the completion of the rake mechanical system installation.

WARNING

At this time, do NOT connect electrical power to any connections installed. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Note:

The electrical cable assembly can be routed to either side but should go to the side the control panel is located on. Refer to Figure 3-21.

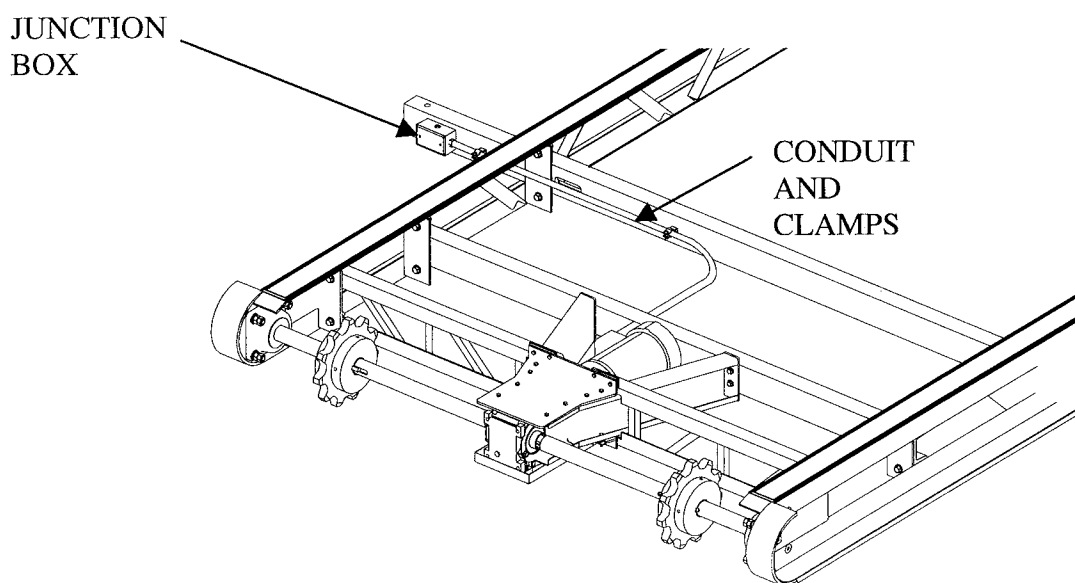


Figure 3-22 Rake Drive Wiring Assembly

Rake Drive Wiring Assembly Installation

The three-phase power to the rake drive is supplied through a wiring assembly shipped loose for field installation. The wiring assembly consists of a rigid conduit with flexible sealite on one end, an electrical junction box on the other end, and mounting brackets:

1. Position the rigid conduit along the lifting beam toward the side the electric cord (electrical power) will be supplied to.
2. Loosely attach the rigid conduit to the mounting brackets.

Read Safety Section before installing and operating equipment

3. Attach the flexible sealite to the junction box on the rake drive motor using the compression fittings supplied. The wiring diagram on the motor should be checked to ensure proper wiring depending on the supply voltage (230 or 460/3/60).
4. Bend the rigid conduit assembly away from the lifting beam next to the rake bin wall, allowing the conduit to clear the rake guide angle.
5. A pulley and electrical counterweight are used to extend and retract the electrical cord as the rake travels up and down. Install the electrical counter weight pulley shown in Figure 3-42 next. Install the bracket and pulley assembly under the top structural member next to the rake lift pulley bracket. Align the pulley with the junction box on the lifting beam.
6. The cord between the junction box on the end of the conduit and the control panel will be installed later in the installation process.

The control panel is normally located on the same side as the electrical cord to reduce the conduit length. It can also be located on the opposite side or in a remote location. Any additional electric cord is supplied by others.

NOTE:

TURBO does not supply a disconnect for the electrical power line going to the electrical cord for the rake drive motor. Must electrical codes require a disconnect next to the motor. The installing contractor is responsible for complying with all local, state and federal electrical codes.

Connect the four (4) wire electrical cable to the junction box at the end of the lifting beam and route to the electrical cord at the top of the 3-21.

Rake Stop Installation

Two to four 2-ton floor jacks are required to elevate and block the rake mechanism in place. Metal stands or wood blocks with a total height of at least 20" (18" minimum) are also required. If one end is raised at a time, only two floor jacks are required. If both ends of the rake are to be elevated at the same time, four floor jacks are required. The procedure described below is for elevating one end at a time. If both ends are elevated at the same time, perform the same task on both ends of the rake.

- 1 Place a floor jack under the lifting beam next to the girder section on both sides of the rake.
- 2 Jack the rake up at least six (6) inches.

CAUTION

The rake should be raised in stages (2-3 inches at a time) and blocks placed under the lifting beam at each stage. If the floor jack fails, these blocks must be structural capable of supporting the entire weight of the rake. Never place your hands, feet or any other part of your body between the floor and the bottom of the rake. Failure to carefully follow these instructions could result in serious injury or even death.

- 3 After the final height is reached to clear the rake stop, place the metal stands or large wood blocks under the rake and lower the rake until it is securely supported by the stands or blocks instead of the floor jacks.
- 4 Install the rake stops with the appropriate hardware.
- 5 Lower rake onto stops and remove floor jacks.

Rake Flite and Chain Installation

Chain is available in plastic, plated and stainless steel. The plastic chain is standard, all others are optional.

Place the rake flites on top of the rake girders at the end. Put the rake flites in order with the "A" rake flite closest to the rear and the "D" rake flite next to the door end. Refer to Figure 3-22.

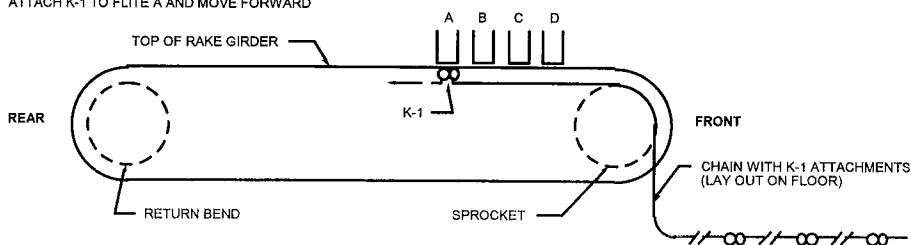
After the flites are in place roll out each set of chain supplied. Each chain sets will have attachments installed (bolts for plastic chain and K-1 for steel chain). The installation of the steel chain will be completed with the master links provided. The K-1 attachments are tagged to indicate which flite they should connect to. Refer to Figures 3-23 and 3-24.

NOTE:

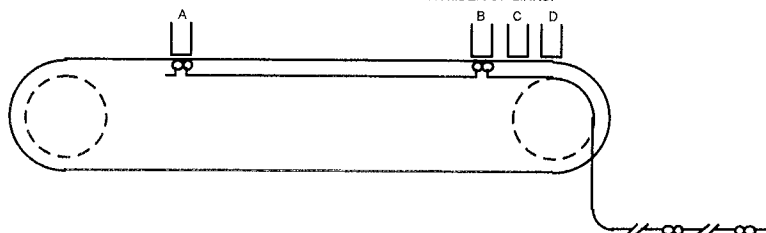
The rake assembly including the chain is factory installed and the spacing between the flites verified for proper installation. The chain should be re-assembled as marked to ensure the spacing between flites is maintained.

Read Safety Section before installing and operating equipment

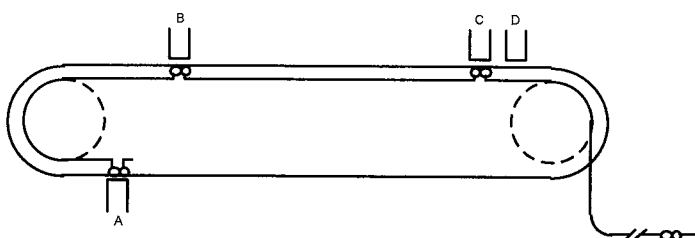
STEP 1
ATTACH K-1 TO FLITE A AND MOVE FORWARD



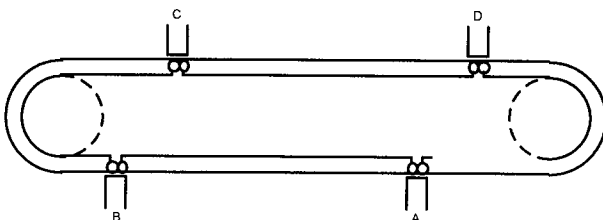
STEP 2
AFTER ATTACHING THE K-1 TO FLITE A, COUNT THE NUMBER OF LINKS FROM THE K-1 TO THE CENTERLINE OF THE SPROCKET. BOTH SIDES SHOULD HAVE THE SAME NUMBER OF LINKS.



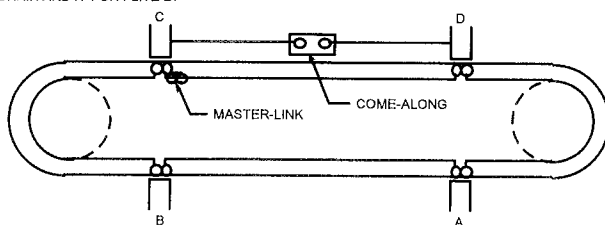
STEP 3



STEP 4



STEP 5
ATTACH COME-ALONG TO TAKE UP SLACK TO PERMIT INSTALLATION OF MASTER-LINK TO CONNECT END OF CHAIN AND K-1 ON FLITE D.



STEP 6
TENSION CHAIN AFTER CHAIN INSTALLATION IS COMPLETED.
ON SPECIAL RAKES WITH MORE THAN FOUR FLITES, FOLLOW THE SAME PROCEDURE.

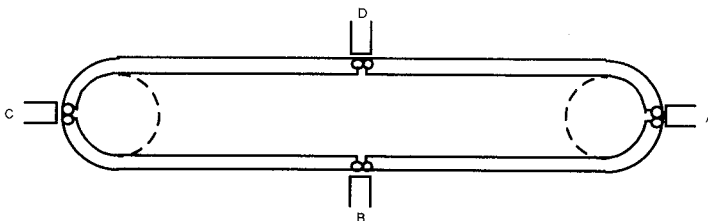
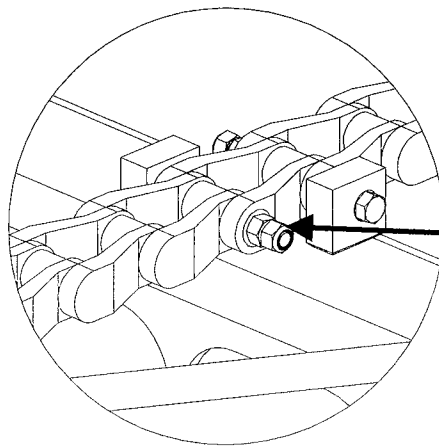


Figure 3-23 Rake Flite Arrangement

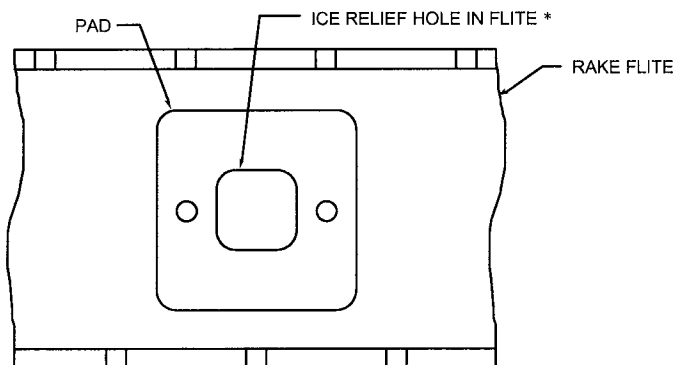
TSR-9431



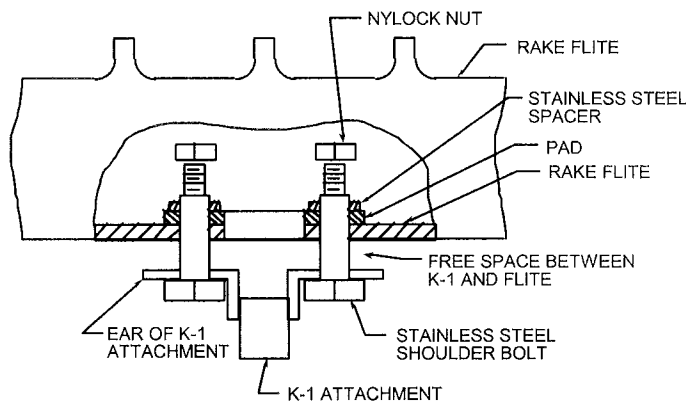
MACHINED BOLT
MUST BE ALIGNED
WITH FLAT IN CHAIN

Figure 3-24 Plastic Chain Attachment

Attach the "A" rake flite to the chain attachments and pull the "A" rake flite toward the rear of the rake until the "B" attachments line up with the "B" rake flite. Repeat the above sequence for the "C" and "D" flites. Refer to Figure 3-25.



* PREVENTS BUILD-UP OF ICE UNDER K-1 ATTACHMENTS



NOTE: AFTER ASSEMBLY, THE SHOULDER BOLT SHOULD ALLOW THE FLITE TO ROCK BACK AND FORTH (I.E., THE K-1 DOES NOT BOLT SOLID AGAINST THE FLITE).

TSR-9426

Figure 3-25 K-1 Attachment- Plated and Stainless Steel Chain

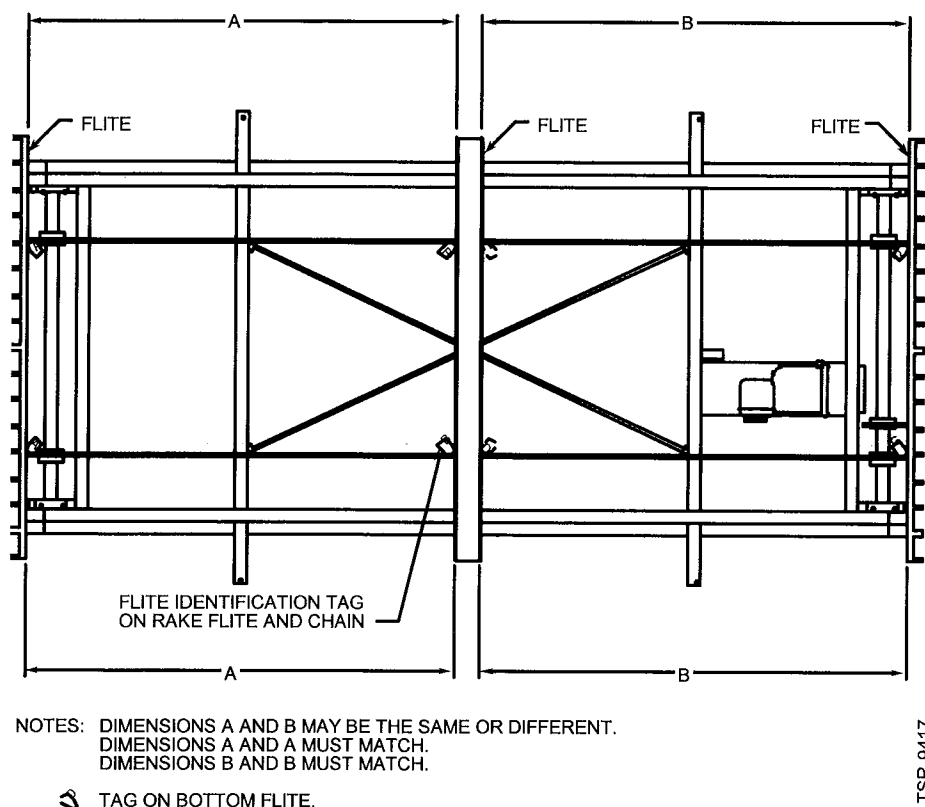


Figure 3-26 Flite Spacing for Steel Chain

Align the idler shaft and drive shaft. The rake flite chains must be parallel to each other and diagonally square with the drive and idler shaft.

Note:

Proper alignment and tension increases chain life.

For rakes with the standard metal chain there should be two (2) inches of slack when the rake flite chain is picked up at a point midway between flites. Refer to Figure 3-27. For plastic chain there will be additional slack to prevent over stressing the plastic chain. Refer to optional plastic chain in the appendix for additional information.

Return Bend Adjustment

Return bends are factory installed on the end of each girder to guide the flites as they travel from the top to bottom rail or vice versa. Manually pull the rake through one complete cycle to adjust and align the two (2) factory installed return bends at the idler end of each girder.

Note: The drive shafts can be turned by hand or with the assistance of a strap or pipe wrench

Read Safety Section before installing and operating equipment

Verify that as each flite passes by, be sure it does not catch or bind. Tighten the return bend bolts. Refer to Figure 3—26.

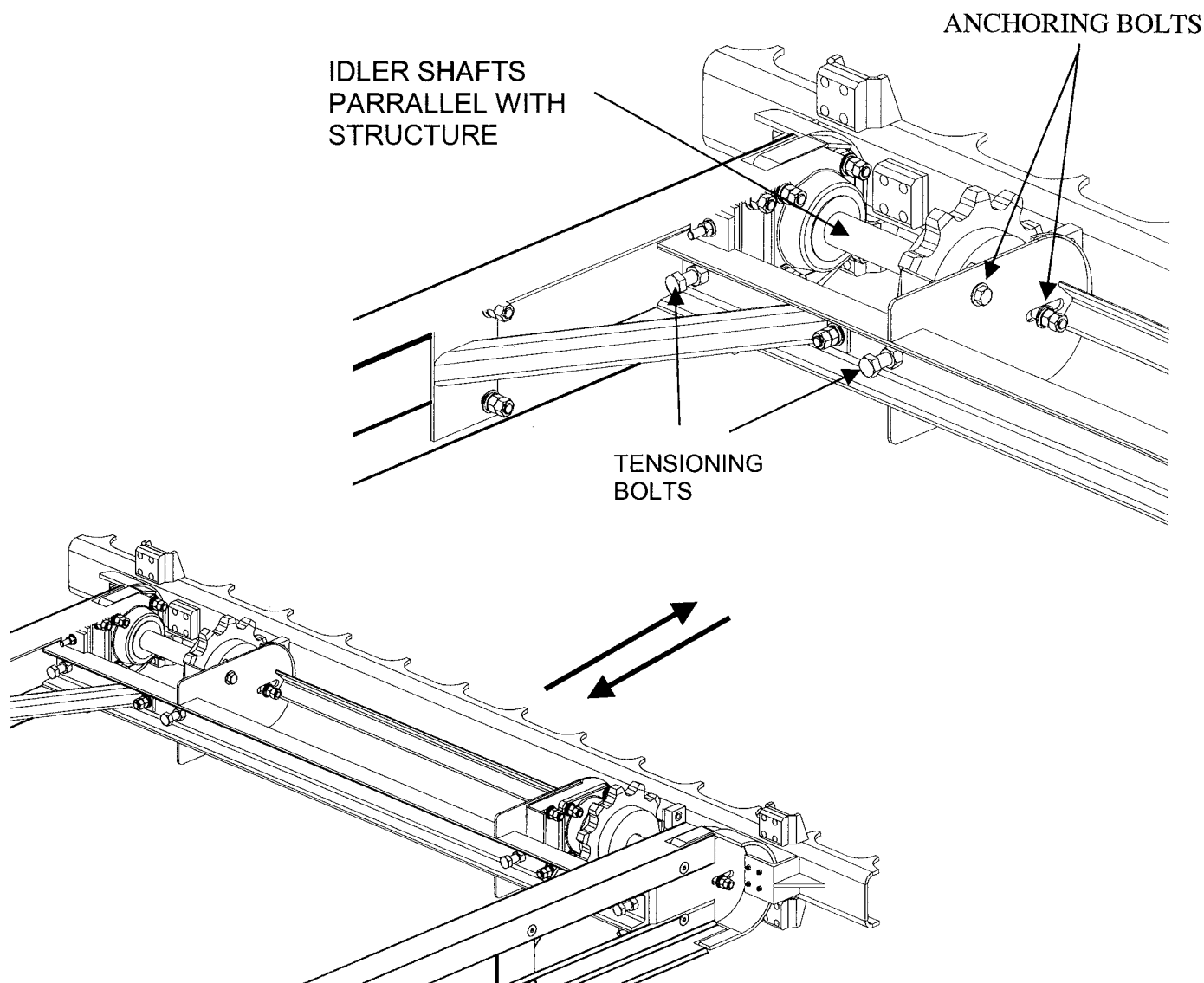


Figure 3-27 Return Bend Detail

Return Bend Adjustment Procedure

1. Loosen the 6 anchoring bolts, two (2) tensioning bolts, and both jam nuts on the return bend assembly.
2. The clearance between the upper and lower rake pads should be equally spaced with the return bend centered between them.
3. If the return bend is too close to the bottom pad, the return bend should be moved out. Turn both adjusting bolts clockwise to push the return bend further out.

Read Safety Section before installing and operating equipment

If the return bend is too close to the top pad, move the return bend in by turning the adjusting bolt counterclockwise.

4. After adjustment of both return bends is complete and the rake flite clearance verified by turning through all four (4) flites, retighten all bolts.

IMPORTANT

If the rake flite chain is adjusted, the rake drive chain must also be adjusted to maintain the proper tension when the rake drive shaft assembly is moved. Refer to Figure 3-26.

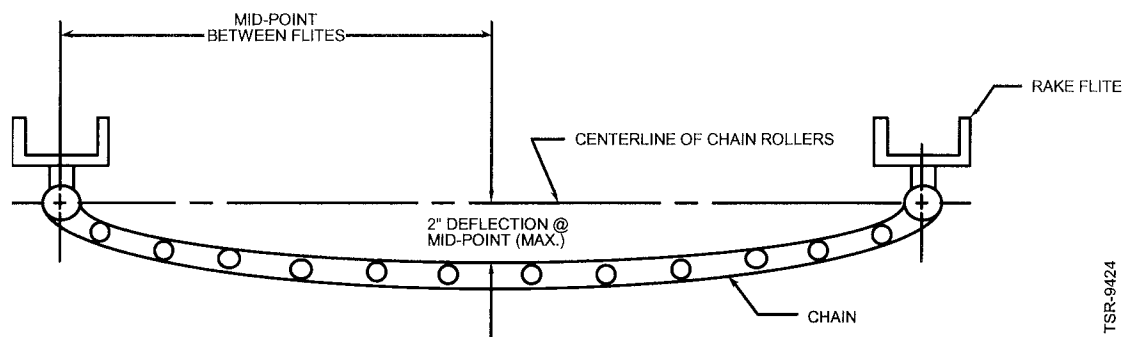


Figure 3-28 Rake Flite Chain Adjustment

Be sure bolts are tight and double-nutted.

IMPORTANT

Retighten bolts after ten (10) hours of operation and again after fifty (50) hours of operation.

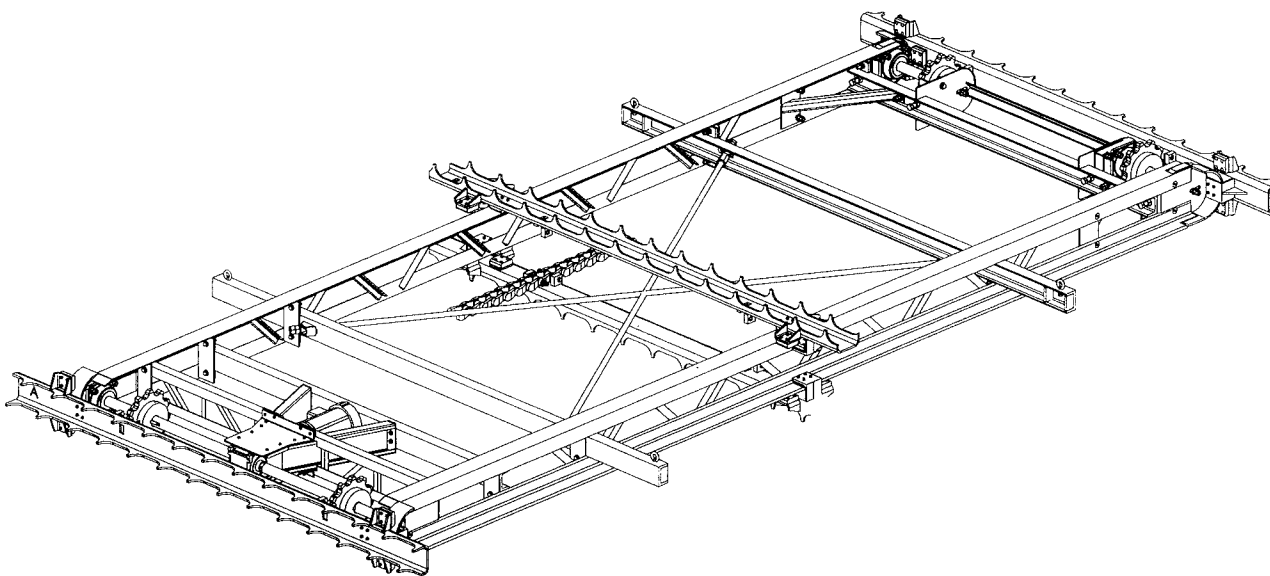


Figure 3-29 Typical CB Rake Assembly (12'-6" x 20' Rake Shown)

7. RAKE LIFT ASSEMBLY INSTALLATION

The hoist pulley assembly includes the hoist cylinder, rake lifting yoke, pulleys, pulley brackets, cables and hoist hydraulic power unit. This mechanism is used to raise and lower the rake assembly in response to signals from the rake system controls. The standard assembly can be located in on either the left or right side of the structure. An optional front mounted hydraulic lift is also available. It should be specified when space is not available on either side to mount and service the hydraulic cylinder or hydraulic power unit. Installation is the same for both sides.

Installation of the lifting assembly will complete the connection of the four cables previously attached to the rake lifting beams to a yoke. The remainder of the installation consists of:

- A. installing the rake lift cable to the lifting beam
- B. installing the rake pulley on the top of the upper I-beam located at the front of the rake
- C. installing the rake pulley on the front of the lower I-beam located at the front of the rake
- D. installing the corner pulley assembly
- E. mounting the cylinder mounting brackets, hydraulic cylinder, and hydraulic manifold block to the bin structure
- F. installing the lifting cable assembly
 - Single-acting hydraulic system
 - Double-acting hydraulic system
- G. connecting lift cable to yoke

Charging the hydraulic system with fluid will be done at the completion of the rake installation.

Preferred Location - Side

TURBO recommends the location of the hoist cylinder on the side of the bin structure – the cylinder mounting can be installed on either the left or right side of the bin. The power unit is located directly above the cylinder on the side of the bin structure. Hydraulic hoses are provided for field installation from the power unit to the cylinder.

Alternate Locations

The hoist cylinder may also be mounted on the front of structure between the upper and lower I-beams.

Front mount hydraulics are an option that is normally used when space limitations on the sides prevent installation or adequate access for service of the cylinder or power unit.

Installation

The following instructions apply to installation on either side of the bin structure. Determine which side of the rake structure the hydraulic cylinder and power unit will be located.

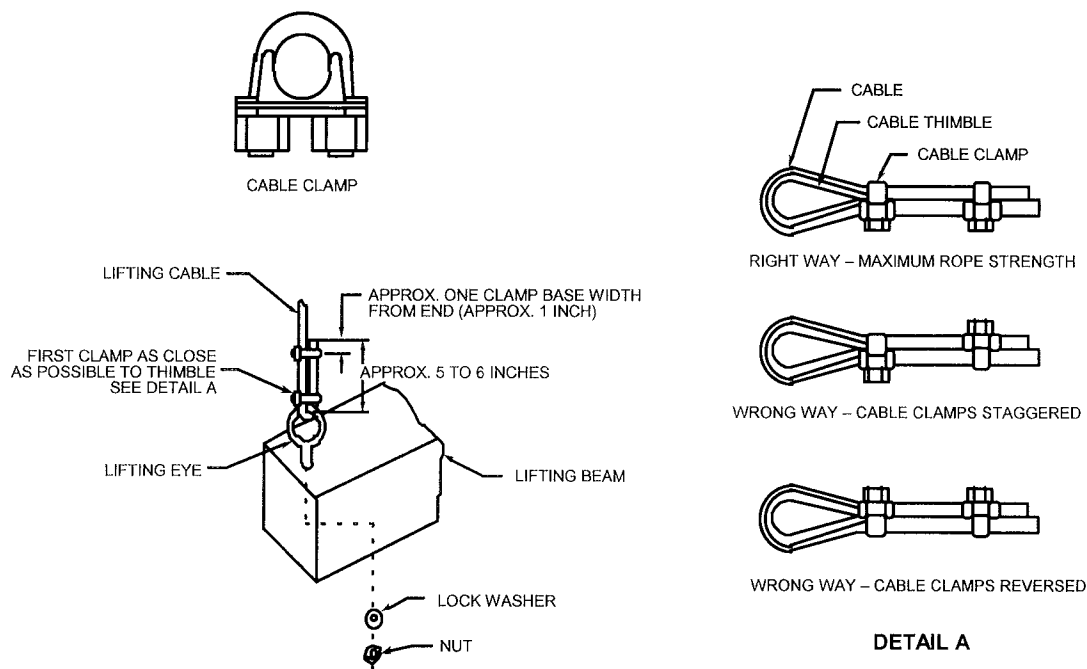


Figure 3-30 Cable/Cable Clamp Installation

A. Rake Lift Cable Installation

Rake Cable Clamp Attachment

After the rake lift pulleys have been installed, the cable should be installed from the lifting beam to the rake pulley. The attachment of these cables to the lifting mechanism yoke at the front of the rake will be done later in the installation process.

Before proceeding, verify that all the bolts holding the rake girders, lifting beams and girder channels are tight. These instructions are recommended by TURBO for installing the cables and cable clamps required for both methods. These guidelines are based on OSHA requirements.

- 1 Insert the rope thimble in the eye bolt located on the end of the lifting beams as shown in Figure 3-29.
- 2 Insert one end of the 1/4" diameter aircraft cable through the eye bolt fitting and insert the cable into the cable thimble. Four cables are provided. The two long cables go the rear lifting beam and the two shorter cables go to the front lifting beam
- 3 Turn back the specified amount of rope from the thimble and apply the first cable clamp one (1) base width from the dead end of the wire rope (U-bolt over dead end – live end rests in cable clamp saddle). Note the clamp alignment shown in Figure 3-29.
- 4 Tighten nuts evenly to suggest torque. Refer to Table 3-1.
- 5 Install the second cable clamp as near the loop/thimble as possible. Turn nuts firm but do not tighten. The nuts on the second clamp should be on the opposite side of the cable from the first clamp

Table 3-8 Wire Rope Cable Clamp Specifications

| Cable Clamp Size (inches) | Minimum Number of Cable Clamps | Rope Turn back (inches) | Torque (ft. lbs.) |
|---------------------------|--------------------------------|-------------------------|-------------------|
| 1/4 | 2 | 4 - 3/4 | 15 |

If a greater number of clips are used than shown in the table, the amount of rope turn back should be increased proportionately. For 3 cable clamps: Turn back (inch) = $3/2 \times (4-3/4) = 7-1/8''$

Space additional cable clamps, if required, equally between the first two (2). Turn nuts, take up rope slack, and tighten all nuts evenly on all cable clamps to suggested torque.

Note:

Use bolts with grease fittings for all pulleys. Refer to the rake isometric drawing enclosed (216-XXXX-XX).

B. Installation of the Rake Pulley - Upper I-beam

1. Install the four rake lift pulleys on the upper I-beam. Two (2) top beam pulley assemblies will be mounted on the left of the I-beam centerline and two (2) assemblies will be on the right. Refer to Figure 3-30 for the orientation of the pulleys and the hole pattern in the top of the upper I-beam.

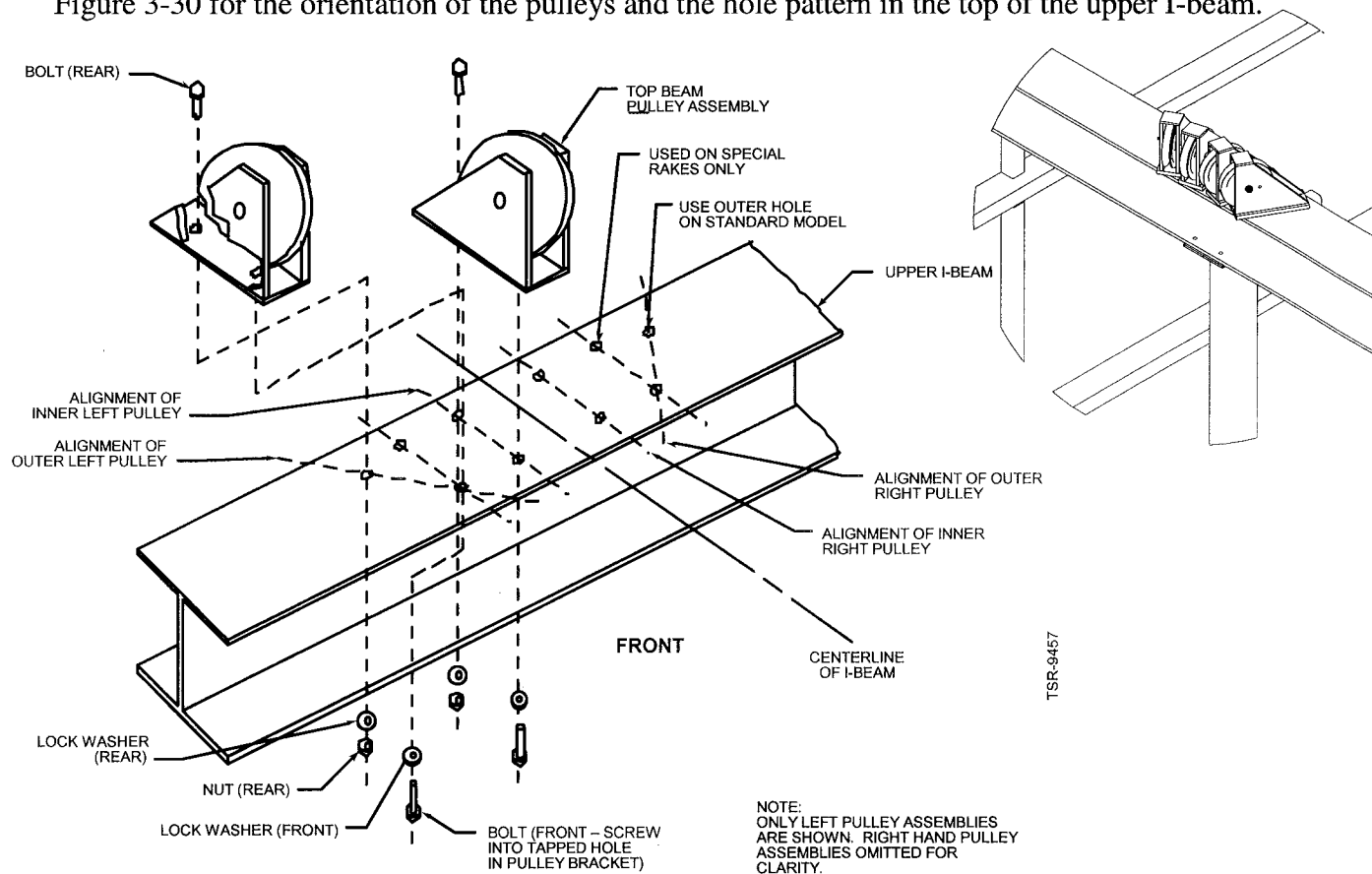


Figure 3-31 Top Beam Pulley Assembly Installation

Read Safety Section before installing and operating equipment

2. Install the two (2) inner pulley assemblies on the top of the upper I-beam. Line the two (2) holes on the pulley assembly with the two (2) inner holes on the I-beam.

Note:

The flat side of the pulley assembly should be on the front edge of the I-beam for proper travel of the cable over the beam.

3. Install the front bolt and lock washer from the bottom side of the I-beam through the clearance hole and tread into the tapped hole in the base of the pulley assembly. Screw in finger tight at this time.
4. Install the bolt for the rear hole from the top through the clearance holes in the pulley assembly and I-beam. Screw the lock washer and nut on from the bottom. Tighten finger tight at this time.
5. Repeat steps 1 through 3 for the two (2) outer pulley assemblies.

Note:

There are two (2) sets of holes for the rear bolts of the outer pulleys (for the 20'-0" and the 25'-0" long rakes). For standard 10'-0" x 20'-0" and 12'-6" x 25'-0" rakes, the outer clearance hole is always used for installation of the outer pulley assembly.

6. Thread the four (4) rake lifting cables from the top beam pulley assemblies through the four (4) holes in the yoke (triangular draw bracket).
7. Insert a cable thimble (provided) in each hole of the yoke as shown in Detail A of Figure 3-33. Loop the cables through the hole and loosely attach two (2) cable clamps to each. These will be adjusted and tightened in a later step.

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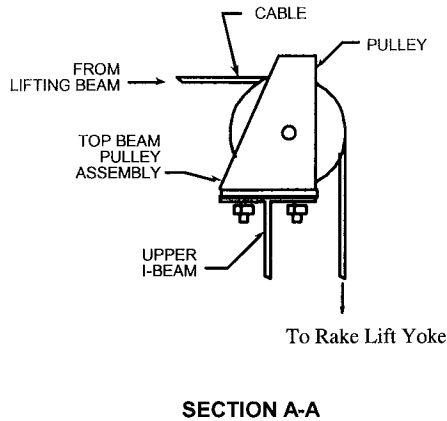
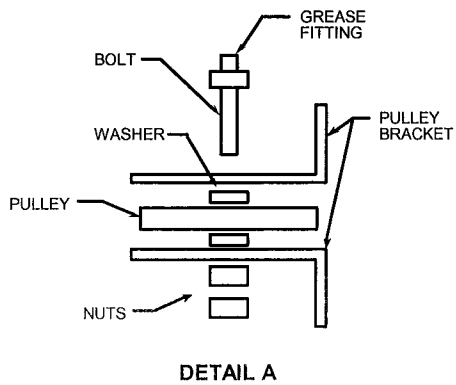


Figure 3-32 Rake Lift Pulley Assembly

8. Connect the ends of the four cables to the lifting yoke shown in Figure 3-33 and 3-34.

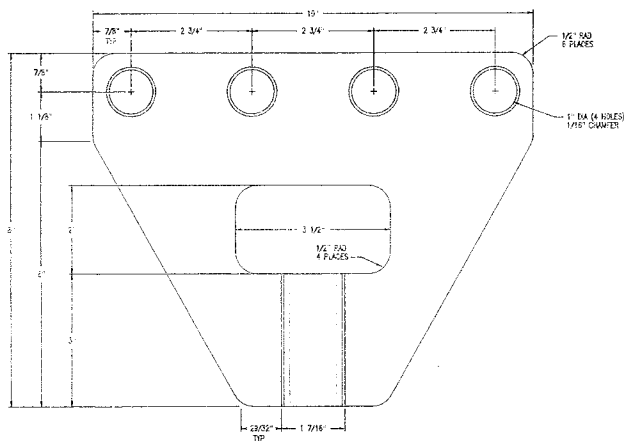


Figure 3-33 Rake Lift Yoke

Note:

Do not cut off the excess cable on the four (4) lifting cables.

Read Safety Section before installing and operating equipment

The cable must run straight across the pulleys. Check and adjust the pulley alignment of the top beam pulley assemblies and the lifting beam pulleys until the cables are properly aligned.

Note:

The top beam pulley assemblies are factory assembled. The bolt used to install the pulley has a grease fitting for lubrication of the pulley mounting stud.

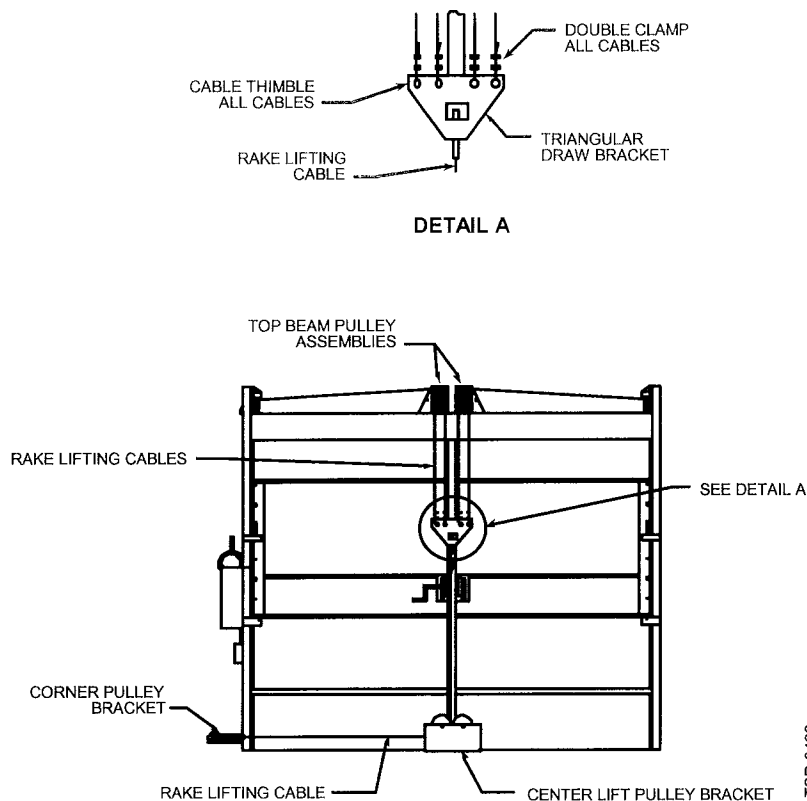


Figure 3-34 Cable Assembly

TSR-9432

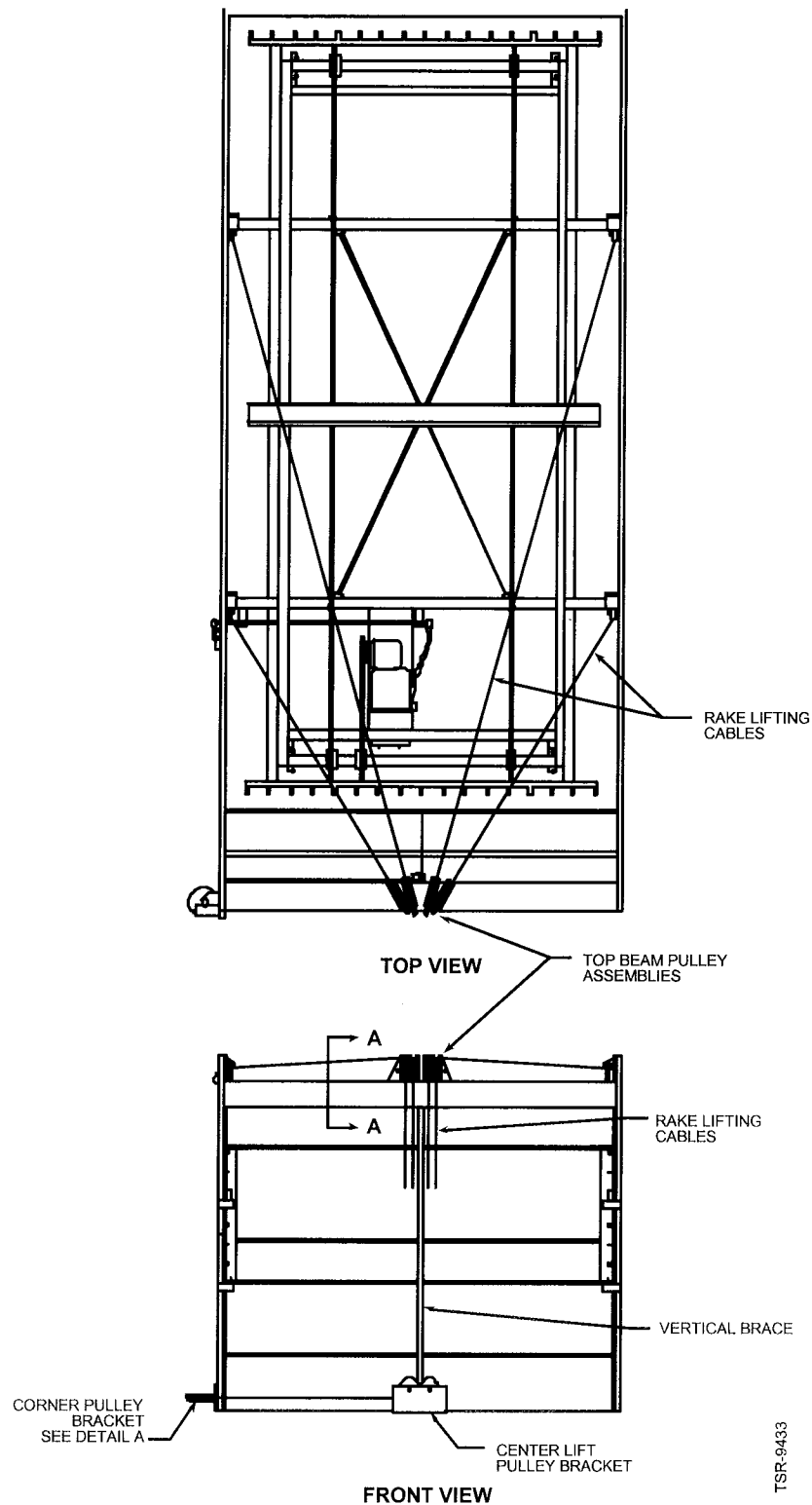
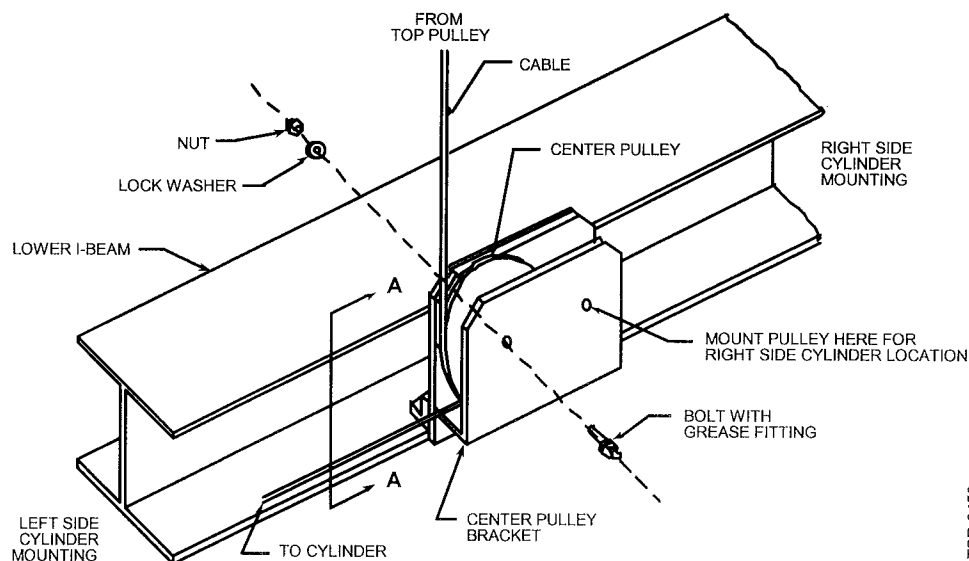
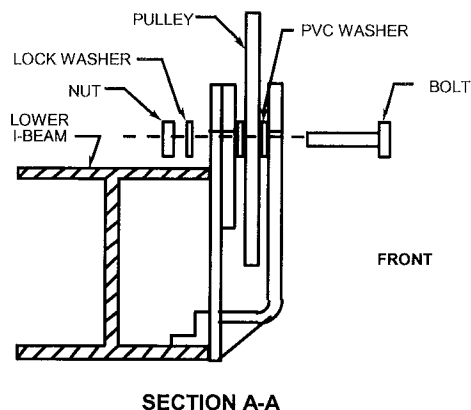


Figure 3-35 Cable Pulley Assembly

C. Lower Beam Center Pulley Installation

The center pulley bracket is factory installed on the lower I-beam.

1. Determine if the hydraulic cylinder is to be mounted on the left or right side of the rake when facing the front of the rake. Refer to Figure 3-35.
 - For right hand cylinder, locate the pulley in the hole on the right.
 - For left hand cylinder, locate the pulley in the hole in the left.



TSR-9456

Figure 3-36 Lower Beam Center Pulley Installation (Left Hand Installation Shown)

2. Insert the pulley, bolt, and poly washers in the pulley bracket.
3. Secure with the nut and lock washer provided.

Note:

Do not over tighten the nut. The pulley should rotate freely with the nut tightened.

4. Tighten all bolts on both the top beam and lifting beam pulley assemblies.

D. Corner Pulley Bracket Installation

The same criteria is used to determine the location of the corner pulley bracket as described in step B above.

1. Locate the corner bracket/pulley assembly on the same side as the hydraulic cylinder. The straight edge of the bracket should be on the front. Refer to Figure 3-36.

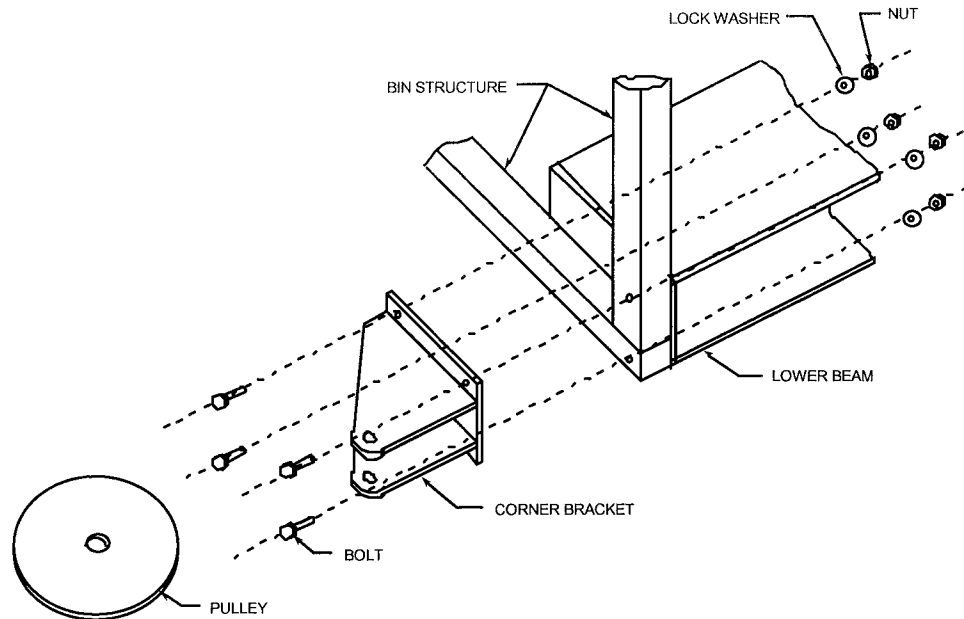


Figure 3-37 Corner Bracket/Pulley Installation

2. Secure the corner bracket to the mounting place located on the lower front corner of the bin structure. Do not tighten the hardware at this time.

Hydraulic Cylinder Installation

The hydraulic cylinder may be mounted on either side of the rake.

1. Mount the cylinder bases to the hydraulic cylinder as shown in Figures 3-38
2. Line the cylinder-mounting bracket up with the holes that are pre-drilled in the lower side bin structure. Holes are provided on both sides for left or right-hand installation.
3. Insert the bolts through the cylinder bases to the rake bin structure using the hardware provided. Leave the bolts finger tight until the cable alignment is verified.

Read Safety Section before installing and operating equipment

Hydraulic Power Unit/Hydraulic Manifold Block Installation

The hydraulic power unit is mounted on the same side as the hydraulic cylinder on the rake bin structure. Installation of the power unit in the rake room is acceptable regardless of the room temperature (i.e., a hydraulic fluid suitable for operation in below freezing environments is supplied with the power unit; no special provisions are required in rooms down to -10°F).

The hydraulic unit can also be mounted remote to the bin structure (i.e., on the wall next to the rake or even in a separate room next to the rake room). If remote locations are utilized, consideration must be given to the routing and length of the hydraulic lines from the power unit to the hydraulic cylinder. Consult the factory for additional information or special hydraulic hoses.

Mounting the Hydraulic Power Unit

1. Position the pump mounting bracket on the vertical bin brace closest to the front of the hydraulic cylinder. The bracket is typically located on the lower bin structure. Refer to Figure 3-39 and Figure 3-40.

Read Safety Section before installing and operating equipment

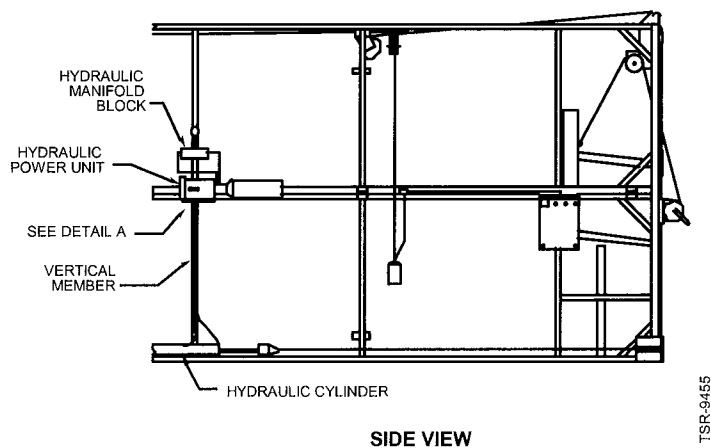
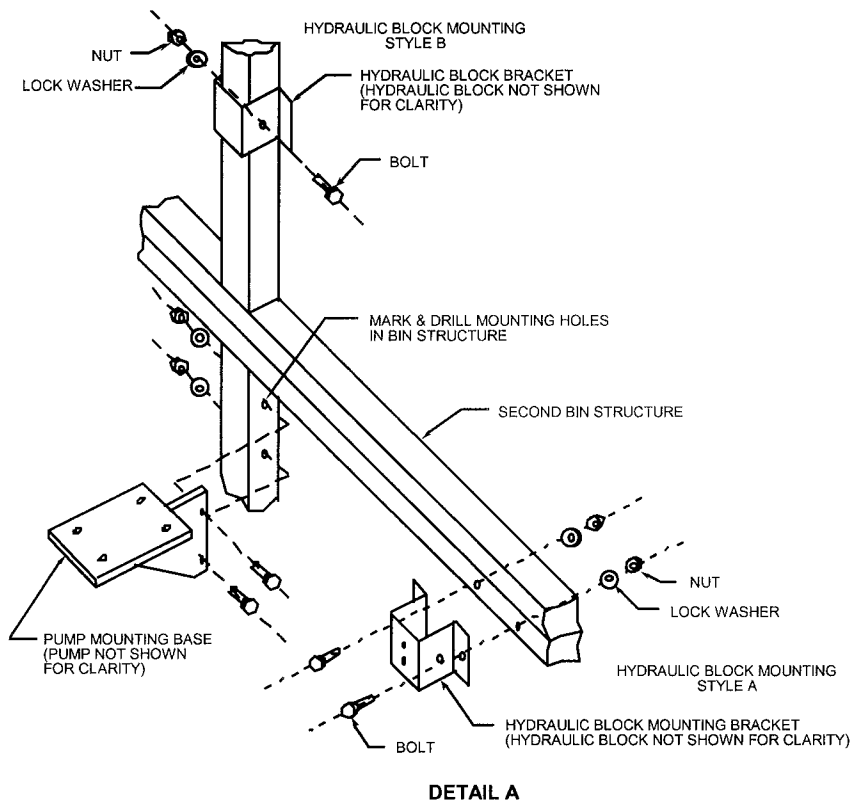
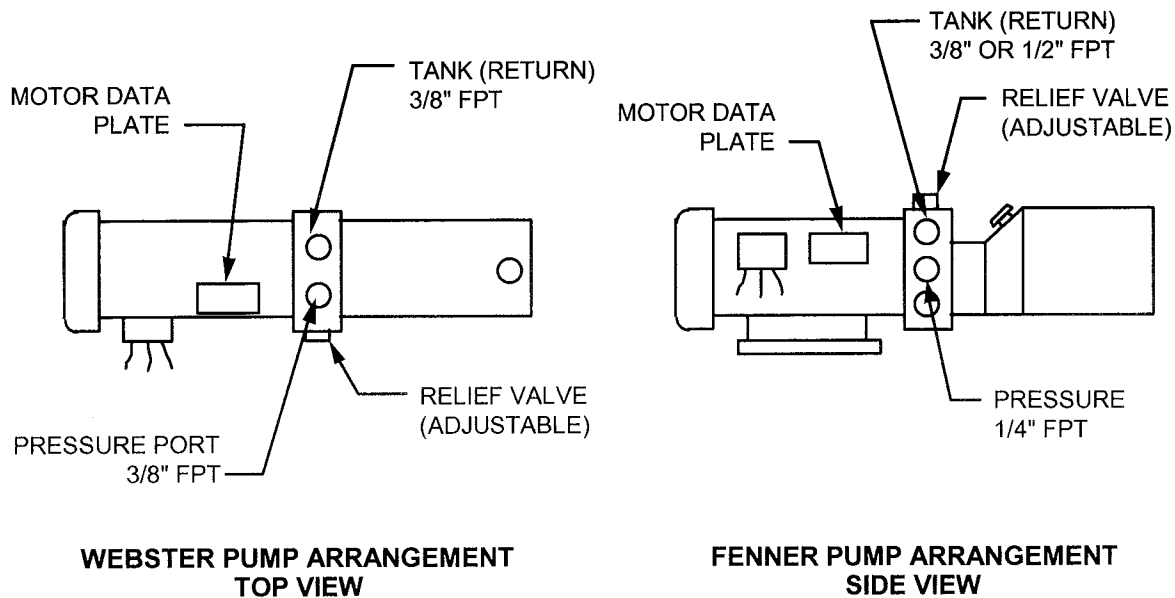


Figure 3-38 Hydraulic Cylinder (Left Hand Installation Shown)

Read Safety Section before installing and operating equipment



TSR-9413

Figure 3-39 Pump Arrangements

2. Using the holes in the bracket, mark the location of the holes to be drilled in the bin structure.
3. Remove the bracket and center punch the hole locations marked.
4. Drill two (2) 9/16" diameter holes in the bin structure.
5. Bolt the pump to the pump mounting base.
6. Install the bracket/pump assembly and bolt in place using the hardware provided.
7. Check that the reservoir tank on the pump is level before tightening the bolts.

Mounting the Hydraulic Manifold Block

The hydraulic manifold block is mounted directly above the hydraulic power unit. Refer to Figure 3-39.

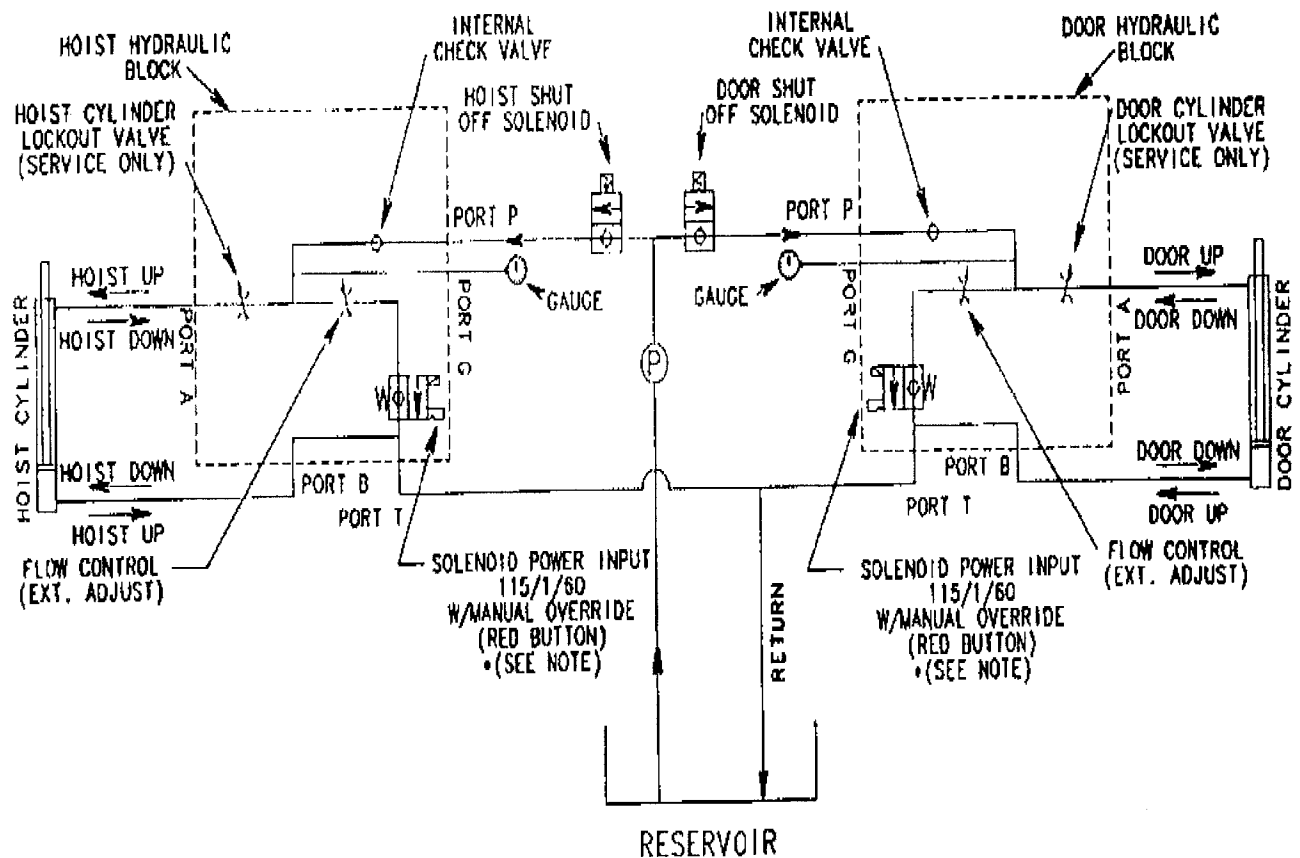


Figure 3-40 Hydraulic Block Schematic(Shown with Hydraulic Door)

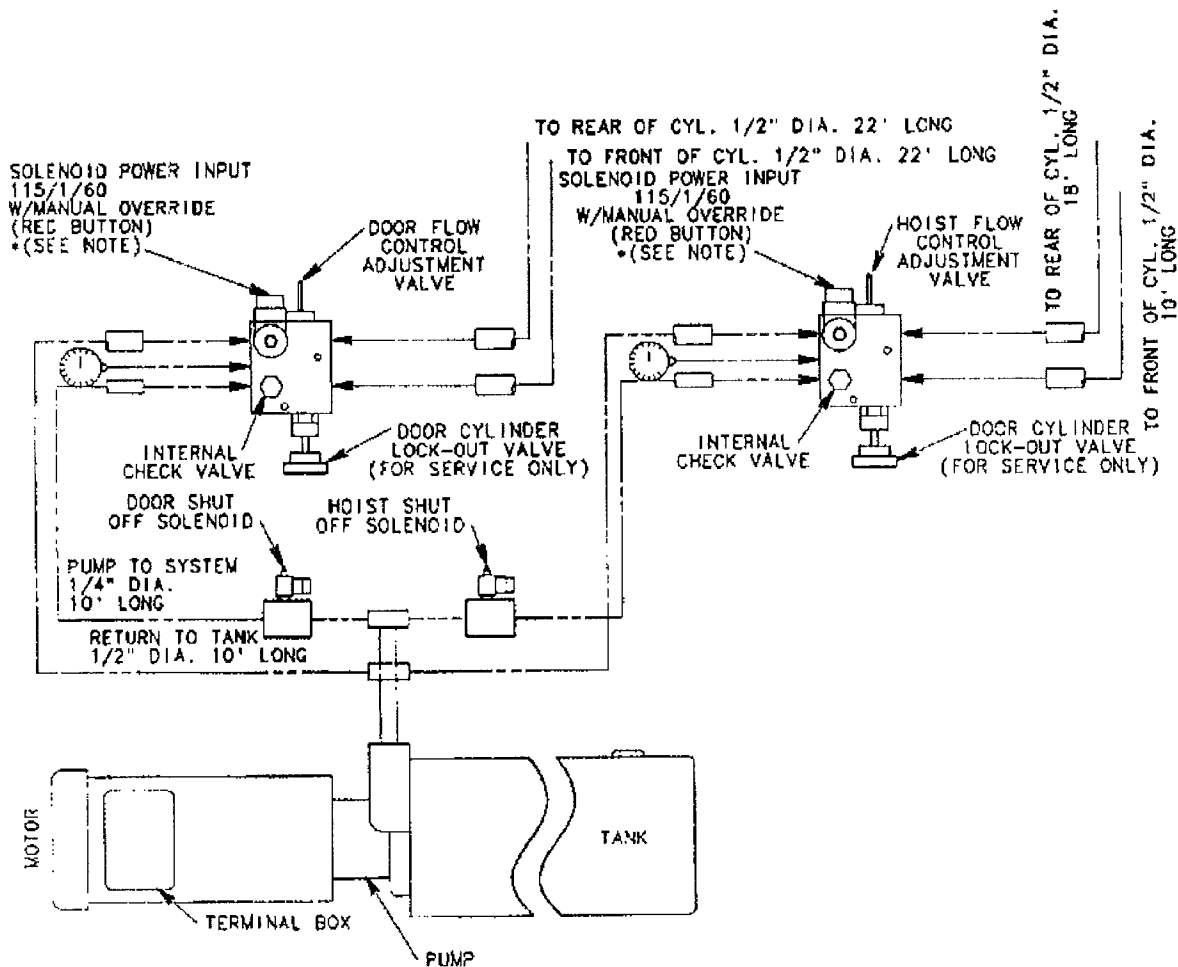


Figure 3-41 Hydraulic Block piping (Shown with Hydraulic Door)

The hydraulic manifold block and mounting bracket are assembled at the factory and are ready for installation.

The bracket may be mounted in either of the methods described below:

Mounting Hydraulic Block

1. Hold the block/bracket assembly on the structural member to which it is to be attached and mark the hole locations.
2. Remove the block/bracket assembly and center punch the hole locations marked.
3. Drill two (2) 3/8" diameter holes in the bin structural member.
4. Mount the block/bracket assembly using the hardware provided. Tighten all bolts.

Hydraulic Hose Installation

Connect the hose shipped loose to the hydraulic manifold block, hydraulic pump, and hydraulic cylinder as follows (refer to Figures 3-41 and 3-42):

| | |
|-------|-------------------------------------|
| _____ | TO REAR OF CYLINDER |
| _____ | TO FRONT OF CYLINDER |
| _____ | OIL RETURN (LARGE DIAMETER HOSE) |
| _____ | OIL TO SYSTEM (SMALL DIAMETER HOSE) |

The short hydraulic hose connects the front of the hydraulic cylinder to the connection marked port A. Screw one end of the long hydraulic hose into the rear cylinder connection.

To complete the assembly of the lifting assembly, the rod of the hydraulic cylinder must be extended. Air in the system causes the reservoir to bubble and overflow. To keep air out of the system while extending the cylinder rod place the free end of the long hose into a bucket of hydraulic fluid (provided) and slowly extending the cylinder. The cylinder will draw the fluid out of the bucket and into the cylinder with little air.

Connect the free end of the long hydraulic hose to port B after the cylinder rod has been extended.

Pour the remaining hydraulic fluid into the power unit reservoir. Proper fluid level and check out of the hydraulic unit will be covered later in the installation process.

E. Cable Assembly

A lifting cable connects the lift yoke to the end of the hydraulic cylinder for both single and double-acting arrangements.

Single Acting Hydraulic Lift

Screw the coupling and threaded cable fitting (attached to the cable) to the end of the threaded cylinder rod as shown in Figure 3-43. The coupling has a female thread on both ends and connects the end of the threaded cylinder rod end to the threaded stud on the end of the lifting cable. The nut and washer on the cable stud should be tightened against the coupling to prevent the coupling from rotating and coming loose during normal operation.

Read Safety Section before installing and operating equipment

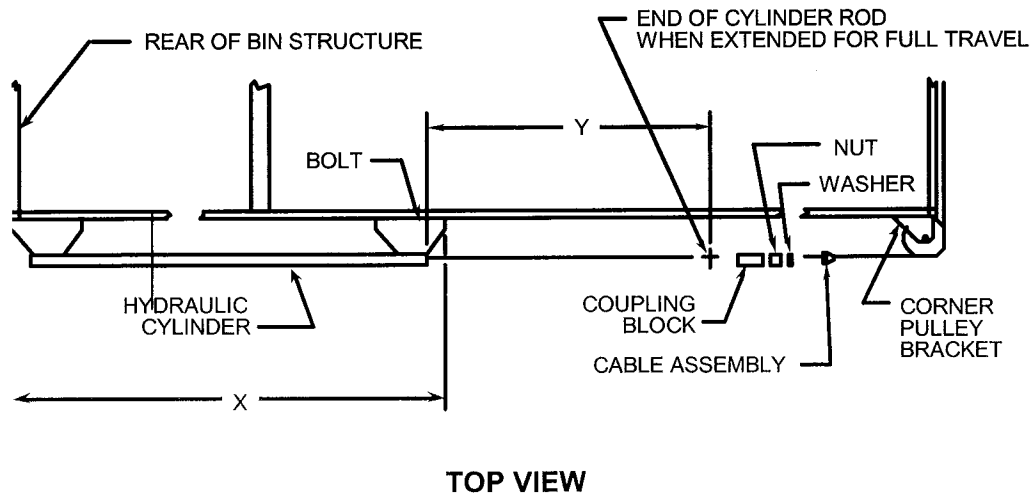


Figure 3-42 Single Acting Hydraulic Lift

Double Acting Hydraulic Lift

Reference the installation drawing provided with the rake and Table 3-9 below to determine the correct "Z" dimension to locate the "cable anchor bracket". Mark the location and center punch. Drill a 9/16" diameter hole in the lower bin structure. Bolt the "cable anchor bracket" to the side of the bin structure as shown in Figure 3-45. The flat side of the bracket should face the hydraulic cylinder.

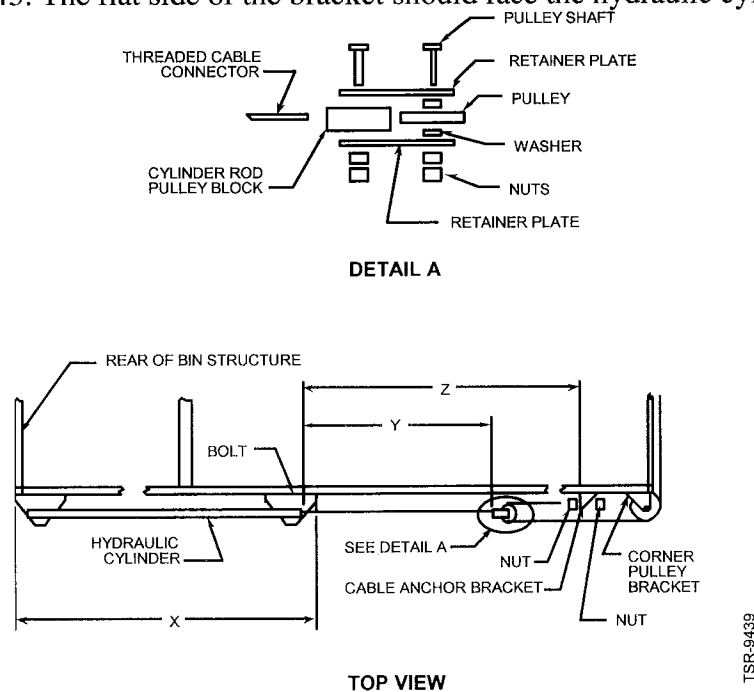


Figure 3-43 Double Acting Hydraulic Lift

Attach the cylinder rod pulley block to the end of the threaded cylinder rod.

Assemble the pulleys between the two (2) retainer plates using the hardware provided.

Note:

The lifting cable should be routed around the pulley before putting on the retainer plates. The threaded end of the lifting cable can not be threaded through the pulley after the retainer plates are installed.

Connect the end of the lifting cable to the cable anchor bracket. The threaded end of the lifting cable will be inserted into the hole in the "cable anchor bracket" and secured using the washer and nuts provided. Double nut the end of the cable stud.

Single & Double Acting Hydraulic Lift

Route the cable around the corner pulley to the front of the rake and lay inside the center lift pulley bracket. Refer to the rake isometric drawing (216-XXXX-XX).

Install the pulley in the center lift pulley bracket using the hardware with grease fittings so that the fittings are on top.

Using Table 3-9, move the cylinder rod end to the position indicated in dimension "Y". This will give the proper max rake height when the cylinder is fully compressed.

**Table 3-9 Cylinder Bracket and Cylinder Rod Position Dimensions
(Refer to Figures 3-46 and 3-47)**

| Model | Cylinder Stroke | Cylinder Lift | Dimensions | | |
|-----------|-----------------|---------------|------------|-----|------|
| | | | X | Y | Z |
| CB-20, 31 | 72" | single acting | 85-5/8" | 66" | NA |
| CB-30, 49 | 72" | double acting | 85-5/8" | 50" | 106" |
| CB-38, 59 | 72" | double acting | 85-5/8" | 60" | 106" |
| CB-50, 75 | 81" | double acting | 94-5/8" | 77" | 106" |
| CB-87 | 81" | double acting | 94-5/8" | 77" | 106" |

X dimension = end-to-end distance between cylinder mounting brackets

Y dimension = cylinder rod extension (travel required)

Z dimension = cylinder cable anchoring bracket location (double acting hydraulic lift only)

Tighten all hardware in the rake lifting mechanism.

G. Lift Cable to Yoke Installation

The final step in the cable assembly installation is the connection of the threaded cable end to the yoke. Refer to Figure 3-33.

Insert the threaded cable stud into the tube on the bottom of the yoke. Using the hardware provided secure the stud end using the flat washer, and two nuts. The second nut is used as a jam nut to lock the stud end in place.

Read Safety Section before installing and operating equipment

Next loosen the four cable clamps on the top of the yoke and pull on each cable to remove any slack. Each cable should be as close to the same tension as possible. After the slack is removed secure the clamps using the torque specified in Table 3-8.

9. FLOOR SCREW CONVEYOR TROUGH INSTALLATION

The floor screw conveyor trough is not supplied by TURBO. The screw conveyor can be mounted above the floor or below the floor (recessed (Reference Step1 of Site Preparation under Floor Screw for additional information on above floor and recessed screw conveyors). Figure 3-54 illustrates the basis arrangement for both types of installations.

After determining if the screw conveyor is above floor or recessed, the next step is to determine if the ice discharge will be left or right. This is determined by the plant design and delivery system layout. The installation steps below will ensure that the bin door and screw conveyor trough is correctly aligned so the door will close properly during operation. The edge of the bin door should overlap the screw conveyor flange $\frac{1}{2}$ " to $\frac{3}{4}$ " as shown in Figure 3-45.

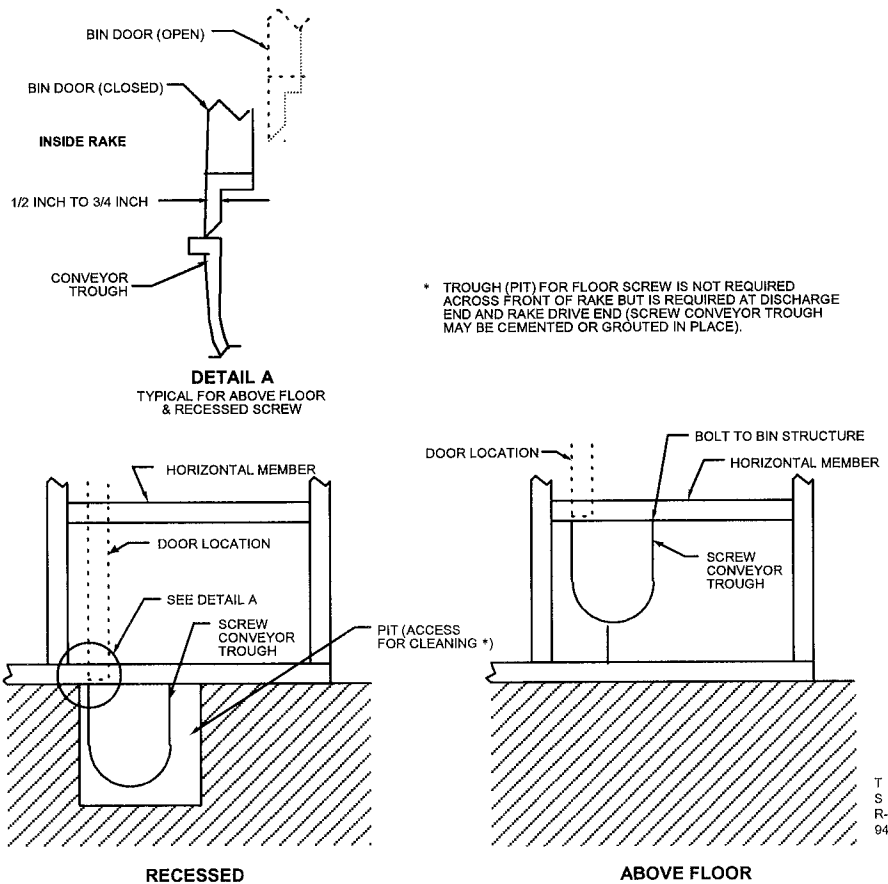


Figure 3-44 Screw Conveyor Trough Location

Note:

Observe all conveyor manufacturers' instructions and warnings for installing the screw conveyor.

Above Floor Screw Conveyor

For above floor screw installations, the top of the screw conveyor will be 17-1/2" from the top of the floor for both 9" and 12" screw conveyors. The installation is as follows:

1. Install the screw conveyor trough (without the screw) under the horizontal structural member at the front of the rake.
2. Attach the flange of the screw conveyor to the bottom of the horizontal bin structure member. Two sets of holes are provided in the bin structure member. The hole next to the vertical bin structure member is used for both the 9" and 12" screw conveyors. The hole located 3-5/8" from the first hole is used for 9" screw conveyors. The hole farthest away is used for 12" screw conveyors.
3. The auger can now be installed following the instructions provided by the supplier of the screw conveyor.
4. Block the area under the trough with suitable material to prevent ice from escaping when the door is open

NOTE:

The floor screw must cover the entire opening of the ice discharge end of the rake; i.e. minimum width would be the width of the bin door. The conveyor can extend out beyond the bin structure on both sides of the rake.

Recessed Floor Screw

A pit is required for the recessed floor screw installation. The pit opening must provide space for the screw conveyor trough, the screw conveyor drive assembly, and for the transition (if applicable) from the floor screw to other screw conveyors or ice delivery devices (rotary airlocks, etc.). Upon completion of the rake system installation and check out of the operation, the pit under the portion of the screw conveyor trough in front of the ice discharge opening may be cemented or grouted in place to seal all voids. The pit under the drive and transition end of the screw conveyor will remain open for service and maintenance access. Drains must be provided for removal of water and condensate from cleaning or accumulation of snow or ice during operation.

If the pit under the screw conveyor in front of the ice discharge area is not to be grouted in, sufficient space under the trough should be provided to allow for cleaning. On above floor installations the clearance for cleaning under the screw conveyor is set by the location of the horizontal bin structure member the trough is attached to.

The installation procedure for the recessed floor screw is the same as the above floor screw installation.

Reference steps 1 through 3. Final anchoring of the floor screw should not be done until after the rake bin door is installed. This will allow the door and screw conveyor interface to be properly aligned before securing the floor screw in place.

Do not connect electrical power to the screw conveyor at this time. All screw conveyors and screw conveyor transitions should be covered to avoid exposure to personnel.

Screw Conveyor Size

CB-Series rakes are typically capable of delivering 30 tons of ice to the floor screw conveyor. For higher delivery rates consult factory. The size of the floor screw and its speed are determined by the actual delivery requirements of the system. In most installations, 9" or 12" screw conveyors are typically used. Screws larger than 12" diameter can be used with slight modification to the rake system (consult factory). Since the floor screw is typically used as the metering device for the system, it is normally sized to run 90-100% full. The tables in the appendix list delivery capacities for 9" and 12" screws at various speeds. The final conveyor size and selection is the responsibility of the supplier of the components. The tables are provided as guidelines only. Standard helicoid screw conveyors with standard pitch, single flight configurations are recommended for all applications. With this design the pitch equals the diameter of the screw conveyor

Refer to Section 1 for guidelines on the location of floor screw (above the floor or recessed below the floor).

To assist in evaluating some of the selection factors, the following example is used:

Example:

A 10' x 20' rake system is used to deliver 30 tons per hour of TURBO TIGAR fragmented ice. As indicated above, the screw conveyor will be selected to run 90-100% full at the design delivery rate. Select the screw conveyor size and speed using the tables below.

Table 3-10 Screw Conveyor Speeds

| | Screw Conveyor Diameter, inches | |
|--|---------------------------------|------|
| | 9" | 12" |
| Delivery, cubic feet/ hour / revolution | 16.4 | 38.4 |
| Percent Loading | 90 | |

A. Fragmented Ice - TURBO C-line, D-line, TR and Vogt VT models (sized fragments/nuggets)

| Delivery Rate, tons of ice per hour | Screw Conveyor Speed, RPM | | Recommended |
|--|---------------------------|----------------|-------------|
| | 9" Dia. Screw | 12" Dia. Screw | |
| 10 | 30 | 13 | 9" |
| 15 | 46 | 20 | 9" or 12" |
| 20 | 61 | 26 | 12" |
| 25 | 76 | 33 | 12" |
| 30 | 91 | 39 | 12" |

Ice density = 40 pounds per cubic foot (sized fragmented ice)

B. Fragmented Ice - TURBO TIG / TIGAR (Random non-sized fragments), TURBO C-line without breaker bar

| Delivery Rate, tons of ice per hour | Screw Conveyor Speed, RPM | | Recommended |
|-------------------------------------|---------------------------|----------------|-------------|
| | 9" Dia. Screw | 12" Dia. Screw | |
| 10 | 30 | 13 | 9" |
| 15 | 46 | 20 | 9" or 12" |
| 20 | 61 | 26 | 12" |
| 25 | 76 | 33 | 12" |
| 30 | 91 | 39 | 12" |

Ice density = 36 pounds per cubic foot (sized fragmented ice)

Shaded areas can be used

Selections in italics are not recommended.

C. Tube Ice - VOGT P-series

| Delivery Rate, tons of ice per hour | Screw Conveyor Speed, RPM | | Recommended |
|-------------------------------------|---------------------------|----------------|-------------|
| | 9" Dia. Screw | 12" Dia. Screw | |
| 10 | 36 | 15 | 9" |
| 15 | 54 | 23 | 12" |
| 20 | 72 | 31 | 12" |
| 25 | 90 | 38 | 12" |
| 30 | 108 | 46 | 12" |

Ice density = 34 pounds per cubic foot (Tube ice)

D. Flake Ice

| Delivery Rate, tons of ice per hour | Screw Conveyor Speed, RPM | | Recommended |
|-------------------------------------|---------------------------|----------------|-------------|
| | 9" Dia. Screw | 12" Dia. Screw | |
| 10 | 38 | 16 | 9" |
| 15 | 57 | 24 | 9" |
| 20 | 76 | 33 | 12" |
| 25 | 95 | 41 | 12" |
| 30 | 114 | 49 | 16" |

Ice density = 32 pounds per cubic foot (Flake ice)

Note:

Shaded areas can be used. Selections in italics are not recommended.

Solution:

Using the table "B" (Table 3-10) above for TIGAR fragmented ice at 36 pound per cubic foot density, the selection would be a 12" diameter screw conveyor running at 39 RPM. A 9" diameter screw conveyor could also be used but would have to be operated at 91 RPM. The 9" diameter screw can handle the required delivery at a conveyor speed below the maximum recommended by TURBO but it would be difficult to maintain the remainder of the conveyors in the systems at reasonable speeds. With the 9" diameter floor screw at 91 RPM, the remainder of the conveyors in the system will have to operate at much higher speeds than would be required with the 12" screw running at 39 RPM. For long conveyors systems with several horizontal and incline screws, this could result in conveyor speeds for the last screws that would exceed the manufacturer's

recommendation. Although the maximum speed may vary from supplier to supplier, 100-150 RPM is generally the maximum recommended speed. Regardless of the recommended maximum, higher speeds result in more snow as well as increased conveyor component wear and maintenance.

For your final selection, determine all factors including:

- The speed of all conveyors
- Conveying distance
- Use of vertical screws and incline screws
- Amount of snow that is acceptable for the process
- Cost of the conveyors
- Space available to make transitions

Consult the supplier for recommendations for your complete conveying system.

Selection Factors

Conveyor Speed

The 12" screw could be used to reduce the conveyor RPM; however, the cost of the larger conveyor must be considered. Also note that any screw conveyors located downstream of the screw must be sized to handle the same capacity as the floor screw. In most cases, this means operating the second screw at a higher speed than the previous screw; the third screw faster than the second, etc. Incline screws typically require higher speed than horizontal conveyors in order to overcome the affects of gravity. Although the use of incline cannot be totally avoided, incline screws above 45° and vertical screws should be avoided if possible. Higher speeds for vertical screws and incline screws above 45° results in more snow and ice fines being generated.

In the example above, assume that the conveying system consists of the floor screw feeding a 20' incline; the incline feeds a 30' horizontal screw that goes to the rake. With the 12" diameter floor screw that was selected to operate at 44 RPM (table indicates 39 RPM – use 40 for safety factor), the incline speed would be 59 RPM (add 10-15 RPM to floor screw speed); the horizontal screw would operate at 64 RPM (add 5-10 RPM to incline screw speed). These speeds would be acceptable for all the conveyors. With the 9" screw in the same example operating at 95 RPM (table indicates 91 RPM – use 95 for safety factor), the incline speed would be 110 RPM; the horizontal screw would operate at 135 RPM. This would exceed the manufacturer's recommended speed and should not be used.

Screw conveyors connected to the floor screw will normally be operated at 30-45 percent loading versus the 90-100 percent used for the floor screw. As indicated above, the RPM of the incline screw was increased 10-15 RPM above the floor screw speed to ensure it can handle the required delivery, and reduce the conveyor loading. Incline screws are normally increased 10-15 RPM while horizontal screw can be increased by 5-10 RPM since they do not have to overcome the effects of gravity. The use of vertical screws is not recommended for this reason. Vertical screw typically would have to be operated at double the speed of horizontal or incline screw due to the vertical lift required. In the previous example a 12" vertical screw used in place of the incline would have to operate at approximately 119 RPM instead of the 59 required for the incline. High speeds required for vertical screws result in high snow levels and should be avoided if possible.

Note:

For conveying systems in excess of 200-250', pneumatic conveying systems should be considered (consult TURBO for additional information).

Snow

As indicated above, one of the factors in selecting a conveying system is the amount of snow that is acceptable. In most applications for packaged ice for consumption, the quality of the ice in the bag is very important and typically slower conveying speeds and larger conveyor are recommended. For industrial applications where the ice is used for cooling (BTUs), the quality of the ice at the final delivery point is typically not the critical factor. In some applications, some snow is desired. In these applications, smaller conveyors operating at higher speeds can be used to reduce the conveying system cost.

Conveyor Covers

Flat covers are typically recommended to avoid packing the ice and generating snow. A retainer wall and safety cover is provided for the floor screw since it has to be open to accept delivery of ice from the rake. Installation of the vertical retainer wall and safety cover is covered in step 12 – Retainer Wall and Safety Switch Installation.

Conveyor Discharge

In some cases the space required may be reduced by using end discharge conveyors in place of bottom discharge. Transitions and covers must be provided for both types. If end discharge is used, service clearance for the end bearing must be considered. In installations with recessed (below floor level) floor screws, end discharge conveyors will reduce the depth of the pit required for the transition between the floor screw and the incline screw in the example above.

If vertical screws cannot be avoided, the transition between the screw feeding the vertical and the vertical screw should include special consideration of a clean out access cover. Bridging of the inlet to a vertical screw is difficult to avoid under all operating conditions. A properly designed clean out section including a lockable service disconnect next to the conveyors will reduce down time and provide for safer operation.

IMPORTANT

Side discharge transitions are not recommended. Side discharge consists of the end discharge of one screw into the side of the other screw. Past performance indicates this arrangement will not provide proper continuous operation without regular jams during surges. Since periodic surges in most conveying systems cannot be totally eliminated, surges will occur.

Conveyor Material of Construction

In most applications, hot-dipped galvanized conveyor troughs and augers (screws) are used. Most suppliers can also provide the same equipment is all stainless steel construction or a combination of stainless steel and hot dip galvanized. The material of selection is based totally on the application or process in which the ice is being used. Galvanized screws are typically used in most industrial applications where the ice is used for its cooling affect. Packages ice applications and applications in

aggressive environments such as exposure to seawater or chemicals may require higher corrosion resistance. Galvanized and stainless steel screw conveyors can also be provided with poly liners to improve the corrosion resistance. Poly liners are also typically used in conveyor systems that do not use hanger bearings to support the screw. In systems with hanger bearings, poly bearings fabricated for ultra high-density polyethylene (UHMW-PE) are typically used. Consult the conveyor supplier for conveyor trough and screw material options, and to determine if poly liners and conveyors without hanger bearings can be used.

10. BIN DOOR ASSEMBLY

The bin door is a unitized structure built in sections ready for assembly. Refer to the bin door assembly drawing provided with the manual for details on the bin door supplied with the rake. The following instructions are typical for all bin door installations.

All standard doors will have a minimum of two (2) and a maximum of four (4) sections. With the exception of the door lift bracket and door arms, all brackets, guides, and access panels are factory installed.

Lay the door section out on the floor in the order shown on the bin door drawing provided. Figure 3-46 and Figure 3-47 show typical arrangements of the two (2) and three (3) section doors. The installation of all doors will be similar to the two samples shown. Doors with two sections will have an access door as shown in Figure 3-46 and 3-47.

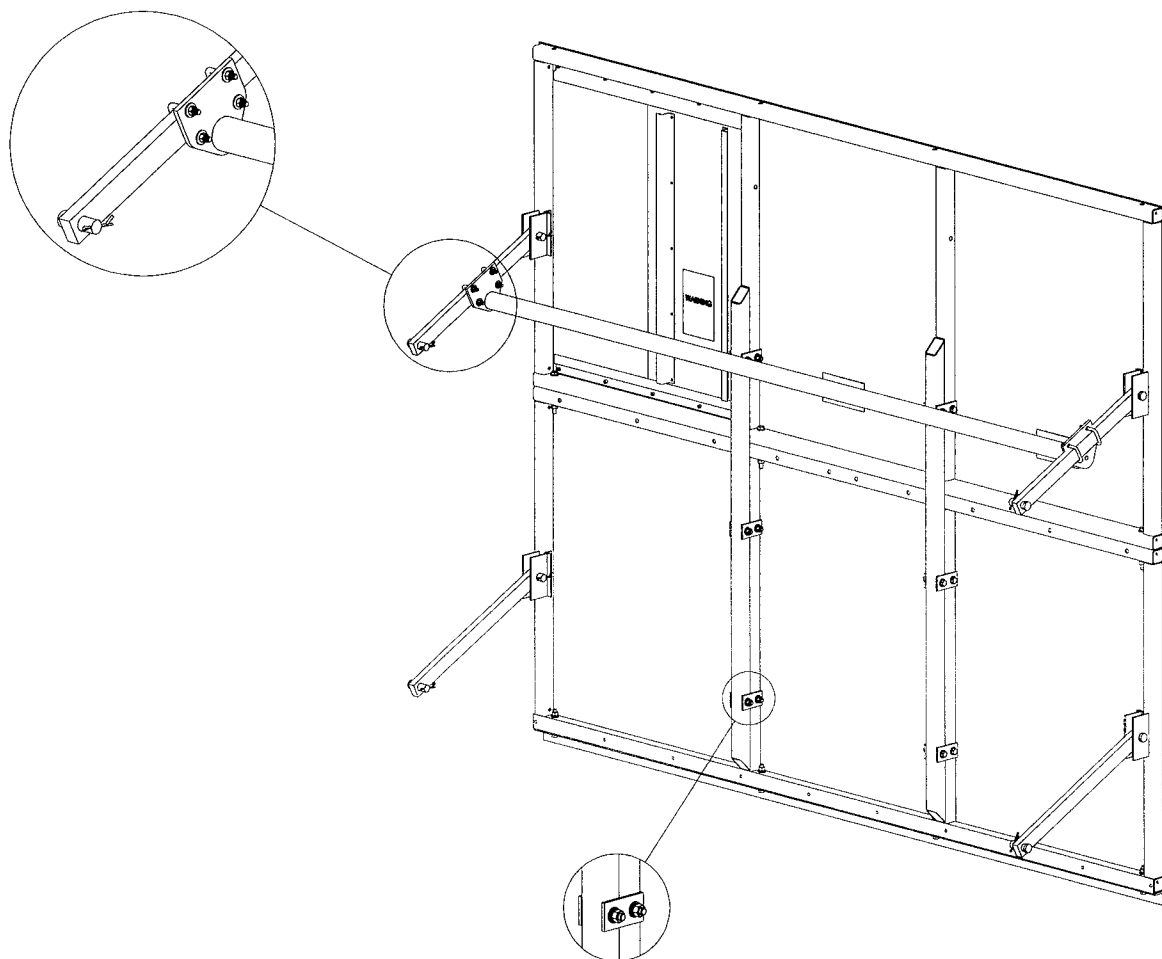


Figure 3-45 Typical Two Section Door

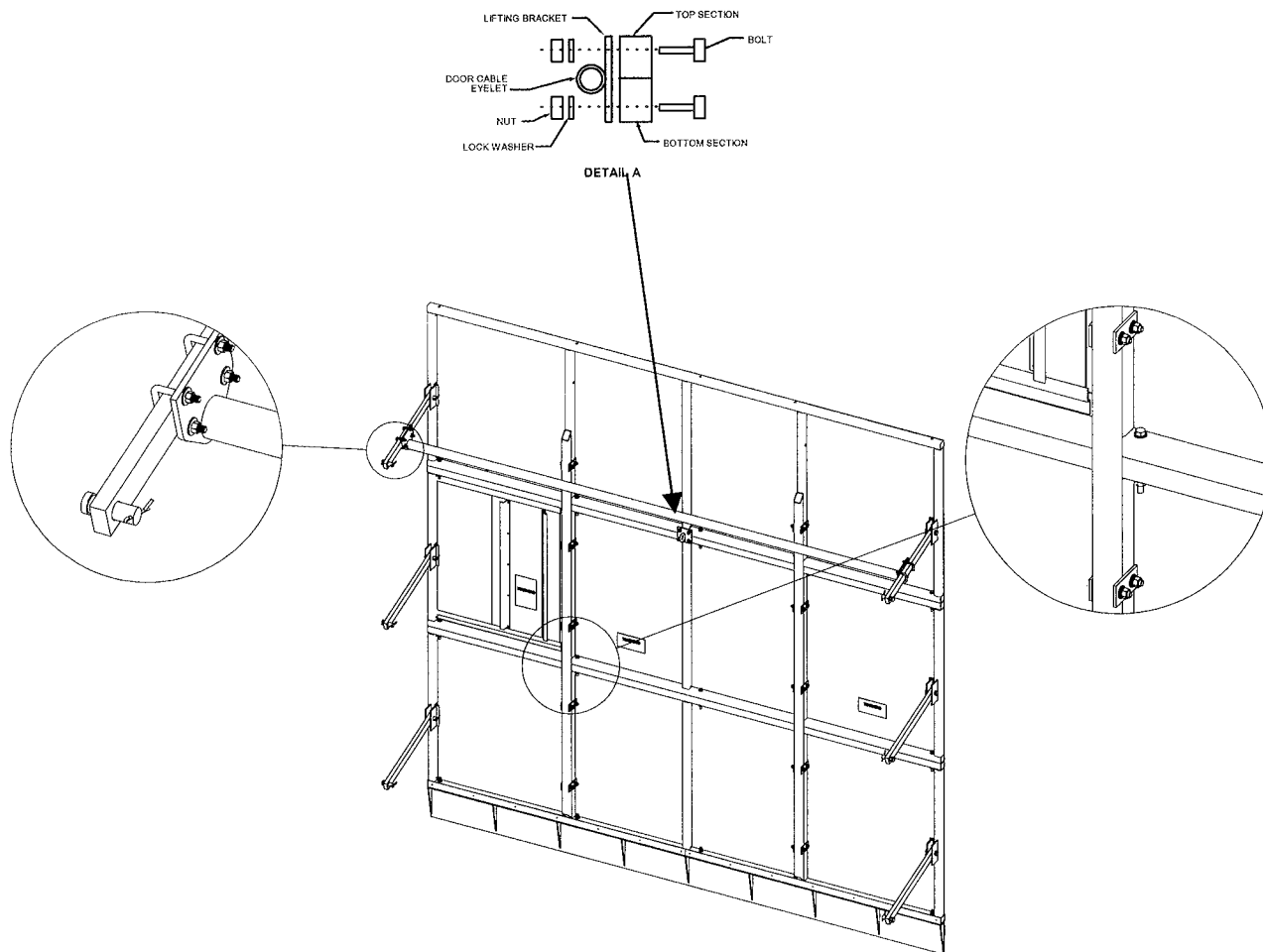


Figure 3-46 Typical Three Section Door

Using the hardware provided (Figure 3-47), bolt the sections together on the floor. Bolt the door lift bracket to the door at the joint between the top and middle or bottom sections. Install the bin door arms to the door brackets on the door. Use the pins shipped with the door arm. Be sure to put the cotter pin in place after inserting the pin. Insert the door arm pin from the outside in toward the inside of the rake. Refer to Figure 3-48.

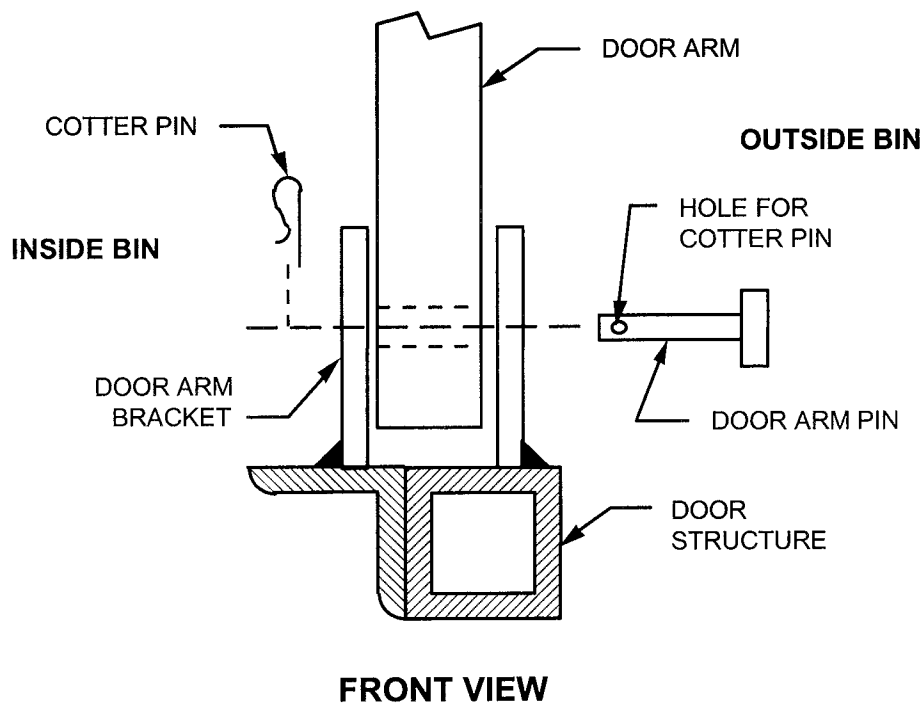


Figure 3-47 Bin Door Arm Detail

Note:

All CB rakes have two (2) or three (3) rows of door arms located on each side of the door. Doors with two (2) rows of door arms will have four (4) door arms; doors with three (3) rows of door arms will have six (6) door arms.

Attach cables to the two (2) top door arm brackets and the door lift bracket. Hoist the door into place using a crane. Position the door on the lip of the floor screw conveyor and then attach the door arm to the door arm bracket on the rake bin structure. Insert the door arm pin and secure with the cotter pin provided.

Alternate Installation Procedure

The bin door may be assembled in place above the floor screw one (1) section at a time using the following sequence:

1. Attach the bottom set of door arms to the door section.
2. Position the lower door section on top of the screw conveyor trough using a fork lift or overhead crane to safely hold the door section in place. Secure the bottom of the door section to the trough to prevent the section from rotating until the next section is installed.
3. Move the other end of the door arm into the door mounting bracket on the bin structure and insert the door arm pin through the bracket and door arm.
4. Insert the cotter pin provided in the hole in the end of the door arm pin to secure the door arm installation.

Note:

Insert the door arm pin in from the outside toward the inside of the rake. Refer to Figure 3-59.

5. After the lower section is secured, position the next bin door section on top of the lower door section.
6. Insert the bolts between the two (2) sections and tighten (finger tight) as shown in Figure 3-47.
7. Repeat steps 1 and 4 to complete installation of the second row.
8. Repeat for the top section on the three (3) section doors.
9. Install the door lift bracket to the bin door in the center of the door at the joint between the top door section and the middle or bottom door section. Tighten all bolts on the door lift bracket.
10. After all of the sections are set in place and the door arms are securely attached, tighten all bolts between the sections.

Table 3-11 Door Section Weight

| Rake Width | Door Section Weight (lbs) | Maximum Assembled Door Weight (lbs) |
|-------------------|----------------------------------|--|
| 10'- 0" | 350 | 1,050 |
| 12'- 6" | 400 | 1,200 |
| 14'- 6" | 450 | 1,300 |

Note:

With the exception of the CB-20 rake (10'-0" x 20'-0") and CB-31 rake (12'-6" x 25'-0"), all doors have a lexan access door in the middle section for use as a service access and for visibility of the rake interior. Service access on the shorter CB-20 and CB-31 rakes are from the top of the door.

WARNING

During operation of the rake, the access door used on the middle section of three (3) section doors must remain closed. Do not open the access door and put your hands, head, or any other part of your body or other objects through the opening. If the rake flites are near the opening, contact with the rake flite could result. Power to the rake must be disconnected and locked out (refer to section 2 - Safety) before entering the rake interior through the access door or from any other location. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Door Arm Stabilizer Installation

After the installation of the door has been completed, the door arm stabilizer should be installed. Refer to Figure 3-49. The stabilizer assembly bolts between either the top of the door arms for two (2) section doors or on the middle set for three (3) section doors.

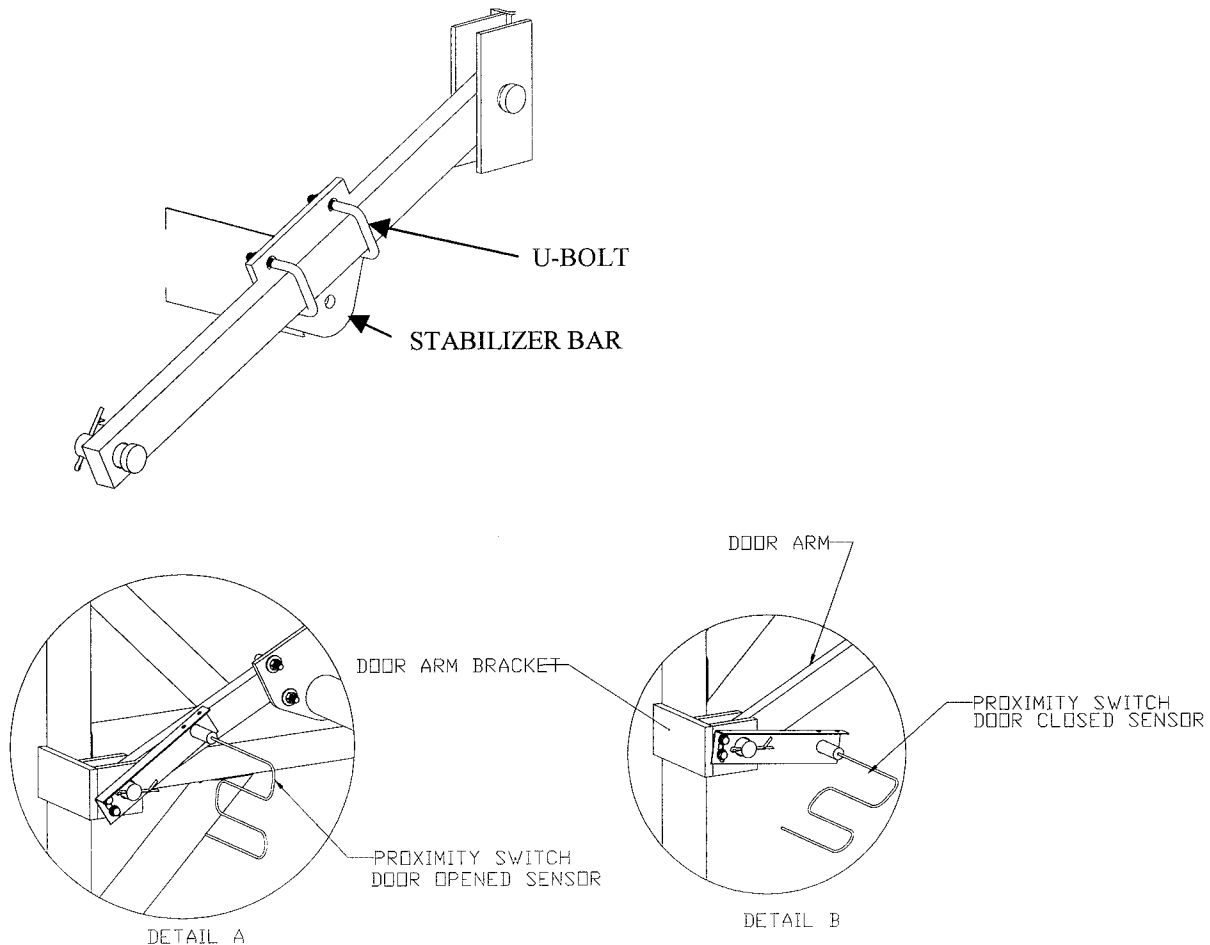


Figure 3-48 Door Arm Stabilizer and Limit Switch Installation

Installation of the door arm stabilizer is as follows:

1. Position the stabilizer assembly between the door arms closer to the door than the frame structure (approximately 6" - 8" from the door). This location should ensure that the stabilizer does not interfere with the door lift cable or the door retainer wall that attaches to the lower section of the door later in the installation.
2. Using the holes in the mounting plate insert u-bolt and hardware

Door Limit Switch Installation

These switches are used to provide a signal to the PLC controls, indicating the position of the rake bin door during the various operation sequences (i.e., door closed or open). For proper operation of the PLC controls, these switches must be installed. The PLC logic is programmed to terminate operation of the rake if the limit switch contacts do not open or close in response to the delivery switch controls. Refer to section 4 - Operating Instructions for the complete operating sequence of the limit switches.

To install the limit switches:

1. Locate the limit switch on the bin structure above the door arm mounting bracket as shown in Figure 3-49.
2. Mark the location of two of the four mounting holes on the limit switch (use one hole on each side, located diagonally).
3. Remove the switch and center punch the hole location. Drill and tap two holes for #10 screws.
4. Mount the limit switch assembly on the bin structure.

The above procedure is typical for both limit switches. Adjustment of the limit switch arms is covered in section 4 - Operating Instructions.

11A. AUTOMATIC HYDRAULIC BIN DOOR LIFTING MECHANISM INSTALLATION

For CB series rakes the hydraulic door system consists of the bin door hydraulic cylinder and a second manifold block for the existing hydraulic power unit. The hydraulic bin door system is used to automatically open and close the rake bin door in response to signals from the programmable controller.

WARNING

Although the operation is automatic, the operator should always visually check the bin door when it is opened or closed to ensure no obstructions exist and that other personnel are not exposed to the area around the door when it opens. A warning label should be located at the front of the rake to alert personnel that the door automatically opens and closes.

The hydraulic cylinder used to raise and lower the rake bin door on standard CB rakes is located at the front of the rake and is attached to the tab on the vertical structural brace between the upper and lower I-beams. The assembly is located at the bottom of the vertical column on all installations. Refer to Figure 3-50.

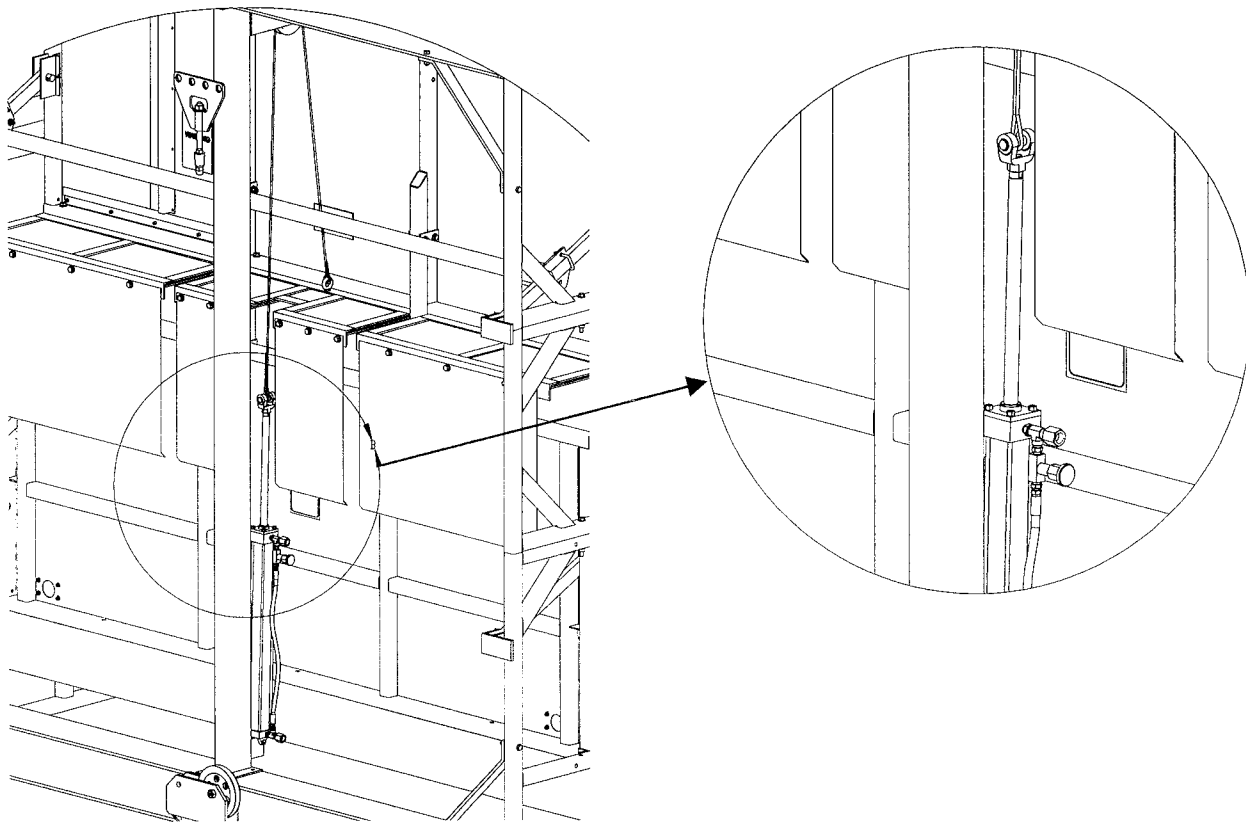


Figure 3-49 Hydraulic Bin Door Cylinder Installation

A second manifold block is added to the hydraulic power unit to control the bin door operation. Refer to Figure 3-39 and 3-51. Installation of the hydraulic block is described in Step 7E.

Hydraulic Cylinder Installation

The same cylinder and cylinder installation is used for all CB rakes. Installation of the hydraulic cylinder is as follows:

- 1. Mount cable pulley on center beam above hydraulic cylinder location**
- 2. Secure the cylinder to the tab on the bottom of the vertical column using the hardware provided.**
- 3. Extend the cylinder rod and screw the clevis bracket to the end of the cylinder rod.**
- 4. Insert the cable thimble around the pin on the end of the clevis bracket.**
- 5. Lay the lift cable into the cable thimble and form a cable loop. Secure the cable using the cable clamps provided as shown in Figure 3-20. Reference Table 3-1 for the proper cable clamp torque.**
- 6. Route the lift cable from the end of the cylinder through the door pulley above the cylinder over to the eyebolt on the bin door (safety cover in all two section doors with above screw).**
- 7. Insert the cable thimble into the eyebolt on the bin door and thread the cable through the eyebolt.**
- 8. Lay the cable into the thimble, remove slack from the cable, form a loop in the cable as shown in Figure 3-29, and secure the cable with the cable clamps provided. Reference Table 3-1 for the proper torque of the cable clamps.**

NOTE:

Do not cut excess cable at this time. Excess cable can be trimmed after the operation of the door lift assembly has been checked out for proper operation.

- 9. Attach the long ½" diameter hydraulic hose to the tee on the rear port on the door cylinder and route to the hydraulic power unit. The long hose is typically 18 foot long.**
- 10. Attach the short ½" diameter hydraulic hose to the tee on the front port on the door cylinder and route to the hydraulic power unit. The long hose is typically 10 foot long.**

IMPORTANT:

A factory installed relief valve is connected between the tee's on the inlet and outlet ports of the door cylinder. The door cylinder operates at a lower pressure setting than the main hydraulic cylinder used to lift the rake assembly. The relief for the door cylinder is set at 1,200 PSIG and relieves from the inlet port (rod end of the cylinder) to the outlet port on the end of the cylinder. Reference Figure 3-51.

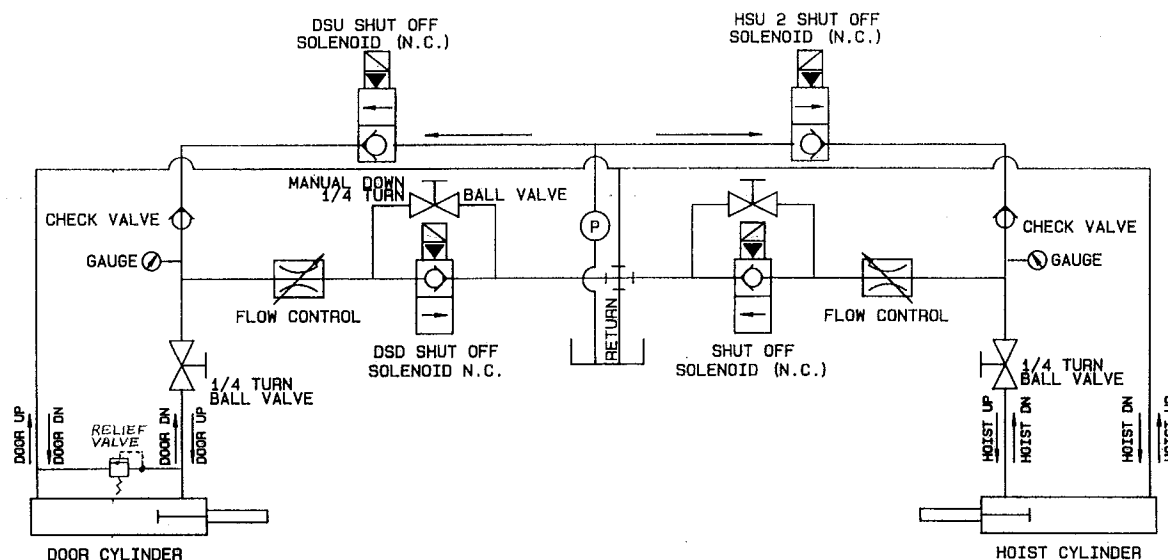


Figure 3-50 Typical Hydraulic Piping with Automatic Bin Door / Door Cylinder Relief Valve

Note: Since the door cylinder operates off of the same hydraulic system as the main cylinder, the hydraulic oil is added when the hydraulic power unit is charges with oil. Reference step 7E for adding hydraulic oil to the system

Limit Switch

The automatic bin door is operated by the outputs of the programmable controller and the logic (program) provided by TURBO. The programmable controller needs inputs from limit switches mounted on the bin door to determine the position of the door during normal operation. A Door Closed limit switch (DCLS) and Door Open limit switch (DOLS) are provided by TURBO for field installed for this purpose. Reference Figure 3-49 in step 10 (Bin Door Assembly) for instructions on installing the limit switches. Both limit switches must be installed and properly wired for the door control to function properly.

12. RETAINING WALL & SAFETY SWITCH INSTALLATION

A retaining wall is provided to cover the top of the floor to prevent entry into the floor screw. The cover is attached to the bin and is fixed..

Retaining Wall Installation

These instructions are the same for the single section and two (2) section retaining wall assemblies. Refer to Figure 3-52.

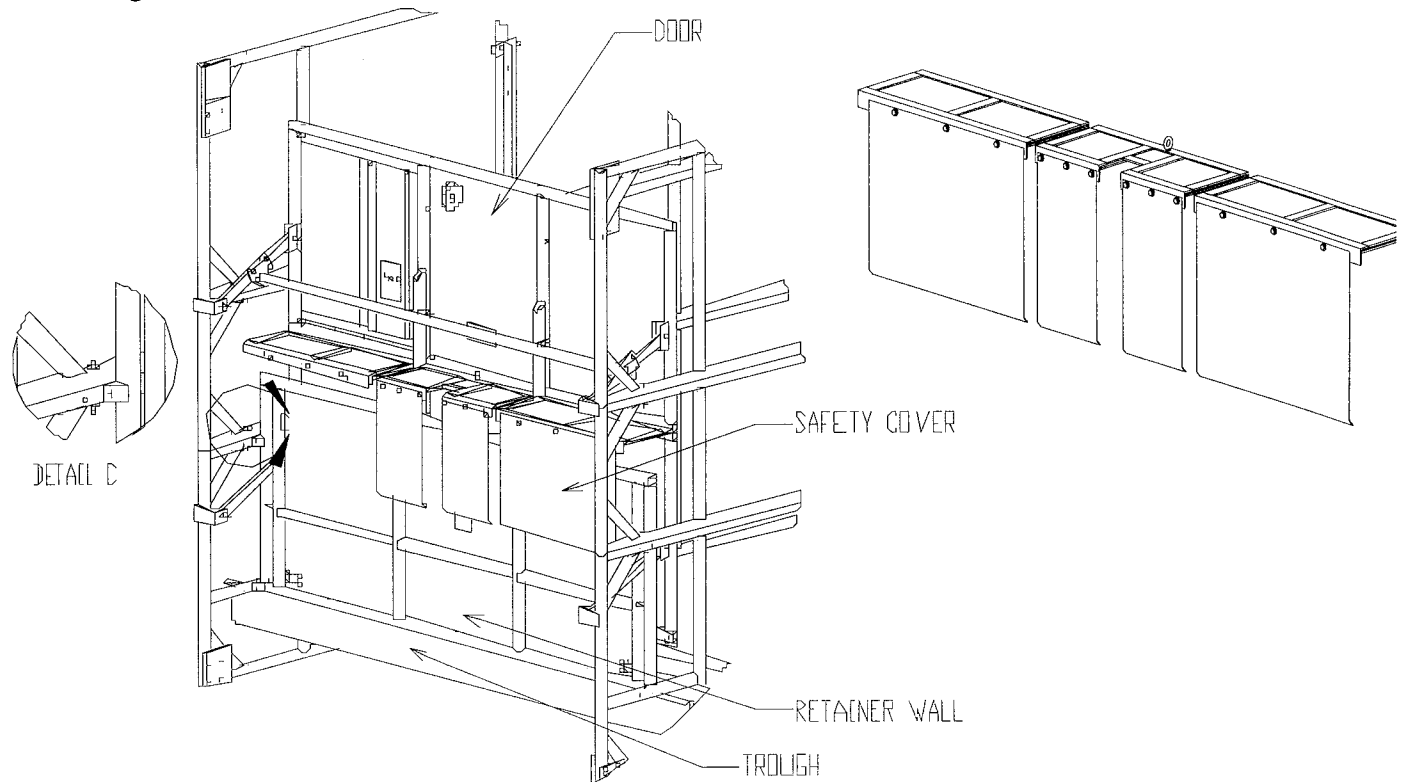


Figure 3-51 Door with Retainer Wall Safety Cover Installation

1. Mount Retaining wall on top of floor screw trough and mark all mounting hole locations.
2. Drill 9/16" holes in trough edge and bin structure
3. Install the retaining wall using the hardware provided.

Safety Cover Installation

A permanent expanded metal safety cover is installed over the retainer wall to prevent access to the floor screw.

The safety cover installation is as follows:

1. After the retainer wall is in place and secured, place the expanded metal safety covers on top of the retainer wall.
2. Using the holes in the safety cover frame as a template mark the location of the holes in the bin door for securing the cover to the bin door.
3. Remove the safety cover and drill the 5/8" diameter holes
4. Mount the safety cover on top of the retainer wall again, and secure to the rake bin door using the hardware provided.
5. Attach the sheet metal or plastic shields to the front edge of the safety cover to prevent access to the floor screw conveyor when the bin door is open and the rake is in use.

Proximity Switch Installation

A proximity switch is in the retainer wall to control delivery of ice into the floor screw conveyor during delivery.

Determine which end the ice will be discharged from. If the ice is discharged to the right as you face the front of the rake, the proximity switch will be located on the right side of the retaining wall. For left-hand discharge, the switch will be located on the left.

Install the proximity switch in the mounting bracket provided by removing the jam nut on the lens end of the switch and inserting the switch into the hole in the bracket. Do not tighten the jam nuts at this time.

Install the bracket and switch assembly to the door using the four (4) mounting bolts provided.

Loosen the rear jam nut until the lens of the proximity switch protrudes through the opening in the retaining wall 1/16" to 1/8".

Tighten both jam nuts to secure the proximity switch position.

Route the hermetically sealed cord on the proximity switch to the control panel.

NOTE: When wiring the safety limit switches on the retaining wall, provisions should be made for quick disconnect of the cable to the switches. This allows for removal of the retaining wall for service. Refer to Figure 3-69. For example use a female twist lock electrical plug on the cable from the control panel and mount a 2" x 4" electrical box with male connectors to the limit switches. This allows easy removal of the retaining wall for service.

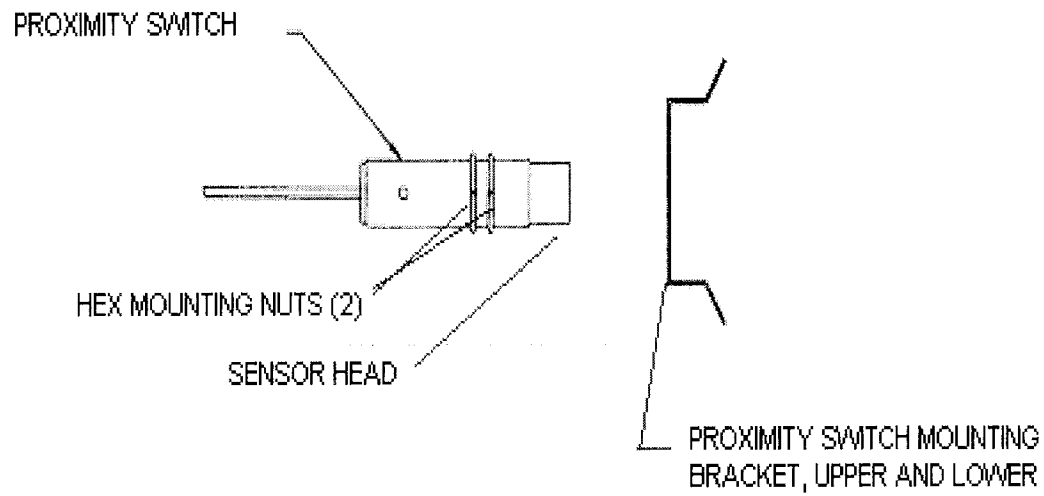


Figure 3-52 Proximity Switch Installation

13. ELECTRICAL CONTROL PANEL & COMPONENTS INSTALLATION

The control panel can be located on either side of the rake bin structure. For safety reasons TURBO recommends installation of the control panel next to the transparent lexan viewing panel on the side of the rake. This allows the operator to view the interior of the rake during changes in operation or for service and maintenance. If the rake is in a below freezing room installation in a remote area next to the rake may be used. In remote installations the operator awareness of other personnel in the area of the rake must be emphasized to prevent unsafe operation during service, maintenance, or changes in the rake operation. For additional information on the control panel location reference Figure 2-4 of section 2 - Safety Section and the "Site Preparation" section of this section. Remote mounting of the electrical control panel should be consistent with good safety practices.

Important

Control panels should not be washed down with pressure cleaners during rake wash down.

WARNING

All electrical work should be done by a qualified electrician only. Do NOT turn power on at this time. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Control Panel Installation

Installation of the control panel is as follows:

1. After the location of the panel has been selected either use the control as a template to mark the hole pattern on the bin structure or measure the holes on the control and transfer these measurements to the bin structure.
2. Center punch the hole location and drill mounting holes in the structure or other structures used to mount the control panel.
3. Bolt the electrical control panel to the bin, near or adjacent to the lexan panel. Remote mounting of the electrical control panel should be consistent with good safety practices. Refer to Figure 2-4 of section 2 - Safety.
4. Secure the rigid electrical conduit (installed in Rake Assembly Section - Electrical Conduit & Electrical Pulley Installation) to the control panel.
5. Connect all other remote inputs from the rake system. In addition to the electrical wiring assembly from the rake drive electrical cord, the following remote (field installed) connections are required:
 - Floor screw limit switch
 - Retainer wall safety switches
 - Door open/close limit switches
 - Hydraulic manifold block solenoid valves.
 - Remote inputs from icemakers or ice generators
 - Using the electrical schematic specified on the cover sheet, connect all electrical wiring to the control panel.

6. Connect three-phase wiring to the large conduit connection (typically ¾" conduit) on the control panel.
7. Connect the wires in the electrical assembly from the rake drive that were previously installed on the side of the rake bin. This is the electrical cord with the electrical counterweight attached to it.
8. Connect wiring to the top of each motor starter in the control panel - reversing rake drive (above), hydraulic pump, and floor screw.
9. Connect wiring to any additional starters that are factory or field installed in the control panel.

Note:

Conduit and electrical hardware from the control panel to the hydraulic power unit, retainer wall safety switches, hydraulic gauge and valve assembly (manifold block), and all remote electrical devices are not supplied by TURBO.

Helpful Hint

When wiring the safety limit switches on the retaining wall, provisions should be made for quick disconnect of the cable to the switches. Refer to Figure 3-64 and 3-65.

Example:

Use a female twist lock electrical plug on the cable from the control panel and mount a 2" x 4" electrical box with male connectors to the limit switches. This allows easy removal of the retaining wall for service.

14. PRE-START-UP CLEANING PROCEDURE

The completion of the rake installation means it is time to begin the clean up before the check out of the operating sequence and starting the system. After all the wiring, structural work, cutting, and fitting have been completed, the interior of the rake and the rake girders should be cleaned and free of debris before starting the Pre-Start-UP check list. .

General Clean-Up

All materials used in the construction and assembly of the rake steel and rake assembly should be removed and all debris removed. After the area has been sweep and the debris removed the entire interior of the rake bin and the rake assembly should be washed down with clean tap water to remove all dust and contaminants that accumulated during installation. Excess water or standing water should be removed to prevent deposit of mineral from the evaporating water.

NOTE:

The use of cleaning agents, steam cleaners (with or without salt additives), or metal preparations is not recommended. The aluminum liner will discolor when exposed to some cleaning agents.

The control panel is waterproof but not watertight and should be covered during the wash down of the installation. Air can be used to clean up the electrical panel as well as remove standing water from other parts of the rake.

Rake Girder Clean -Up

The rake pads are covered during shipment to protect them from exposure to ultraviolet light that hardens the pad. The standard stainless steel girder liner that the rake pads ride on can become contaminated during installation and must be cleaned prior to operation. The following procedure should be used to clean the stainless steel girder liner:

1. After the general wash down described above, wipe off the upper and lower girder liners with a dry clean cloth to remove all dirt and other loose contaminants on the surface.
2. Mix a 50/50 mixture of citric acid and water. For most rakes it will require approximately a gallon of citric acid mixed with a gallon of water in a five-gallon bucket.
3. Using either a nylon brush or other non-scoring cleaning pad, scrub the stainless steel girder liners with the diluted citric acid solution. The mixture can be left on the girder liner for up to one hour.
4. Rinse the girder liners with clean tap water to remove the acid residue. The nylon brush can be used to ensure that loose contaminants are removed.
5. After the girder liner has been rinsed, the surface of the girder liner should be wiped dry using a clean cloth or rag.

The girder liner should now be ready for normal operation. The girder liner should be checked periodically during the first 50 hours of operation for any residue. In some cases it may be necessary to repeat the cleaning operation during the wear in period for the rake pads.

15. INSTALLATION & START-UP CHECKLIST

1. Check that all bolts and hardware have been tightened and secured.
2. With the hydraulic cylinder fully extended, check the fluid level in the hydraulic power unit reservoir. It should be about 1/2 to 3/4 full.
3. Check that all safety and warning labels are on the control panel, bin door lexan access panel, and retaining wall. Notify TURBO if any labels are not present. Refer to section 2 - Safety.
4. Check that all personnel are out of the rake and are clear of any moving components.
5. Have a qualified electrician turn on the single-phase control power only; i.e. the three-phase is OFF. Check out the electrical control sequence using the electrical schematic. Refer to section 4 - Operating Instructions.
6. Check the position of the following valves on the hydraulic power unit:
 - Manual bypass valves closed (handle 90° to the valve).
 - Ball valve open (handle in line with the valve).
 - Flow control valve (close valve and then open 1/8 of a turn).

Note:

Under normal operating conditions, the flow control valve should not be opened more than 1/2 of a turn. More than this could cause the rake to descend too fast and possibly damage the rake.

7. Have a qualified electrician turn on the three-phase power. Refer to step 4 above.
8. Set the hydraulic relief valve by pressing the manual up button on the control panel door.
 - Remove the acorn cap and screw the slotted screw all the way out. This will result in all the hydraulic pressure being relieved to the tank - the rake will not raise due to lack of hydraulic pressure.
 - Turn the rake selector switch to MANUAL UP to turn on the hydraulic power unit.
 - Turn the relief valve stem in until the rake starts to rise.
 - Turn another 1/4 of a turn for final adjustment. This will allow the hydraulic power unit to lift the rake assembly with the least amount of hydraulic pressure. If the rake should bind or jam during operation excessive hydraulic pressure can not damage the rake with the relief properly adjusted.
9. To purge any air in the hydraulic system alternate the controls from MANUAL UP to MANUAL DOWN.
 - Turn the rake selector switch to MANUAL UP and raise the rake a few inches. Turn the rake selector switch to MANUAL DOWN and lower the rake to the original position.
 - Repeat the above several times to ensure that all air is purged. The amount of travel can be increased each time as the air is purged.
 - At the completion of this step, lock out the electrical power and verify that all bolts and cables in the lifting system are still tight and secure.
10. Check the triangular draw bracket for even loading. Raise the rake to the top, stopping periodically to check for interference or binding.

11. Continue in MANUAL UP until the rake stops. The hydraulic cylinder rod should be fully retracted (bottomed out) instead of the lifting cable clamps contacting or interfering with the pulleys.
12. Check to see if the full travel of the rake was obtained. If not, lower the rake to the rake stops (MANUAL DOWN), pull out the cylinder rod as needed to achieve rake height, and shorten the four (4) lifting cables as required or adjust the stud in the triangular draw bracket (refer to Figure 3-36 and 3-37). Do NOT cut excess cables. On double acting hydraulic lift, divide the additional length required by two (2) to obtain the correct length.
13. If the cylinder does not fully retract before the cable clamps interfere with the pulley, lower the rake to the rake stops and lengthen either the four (4) lifting cables or the triangular draw bracket as required. Do NOT cut excess cables.
14. Raise the rake to the top and check the cable clamps and cylinder rod positions.
15. Check the hydraulic fluid level in the reservoir to ensure that it is still 1/2 to 3/4 full.
16. Raise the rake to the top and lower several times for final purge of any air in the hydraulic system.
17. Fill the reservoir 1/2 to 3/4 full if necessary.
18. Turn the selector switch to the LOAD position and observe the operation of the rake flites in the forward and reverse directions.

Note:

This operation is controlled by a timer. Refer to section 4 - Operating Instructions for the rake drive forward and reverse sequence.

The rake should now be ready for normal operation. The operating controls and sequence are described in the next (Operating Section) section.

Read Safety Section before installing and operating equipment

TURBO[®]

REFRIGERATING

CB Series Rake Manual Installation, Operation & Maintenance

OPERATING INSTRUCTIONS

This section describes the rake operating sequence, how to use the control panel, and hints for efficient operation. Only standard features are discussed. Refer to section 8 - Optional Features & Accessories for additional information.

Control Panel Devices

The standard control panel consists of:

- Master control switch (2 position-keyed)
- Emergency stop button
- Operator Interface
- Variable Frequency Drive for Rake Drive and Floor Screw Conveyor
- Magnetic starters for other motors
- Programmable logic controller (PLC)
- Control relays
- Failure Indicator light
- Control power circuit protection

Refer to Figure 4-1 for a typical control panel door. The function of each standard control panel component is described.

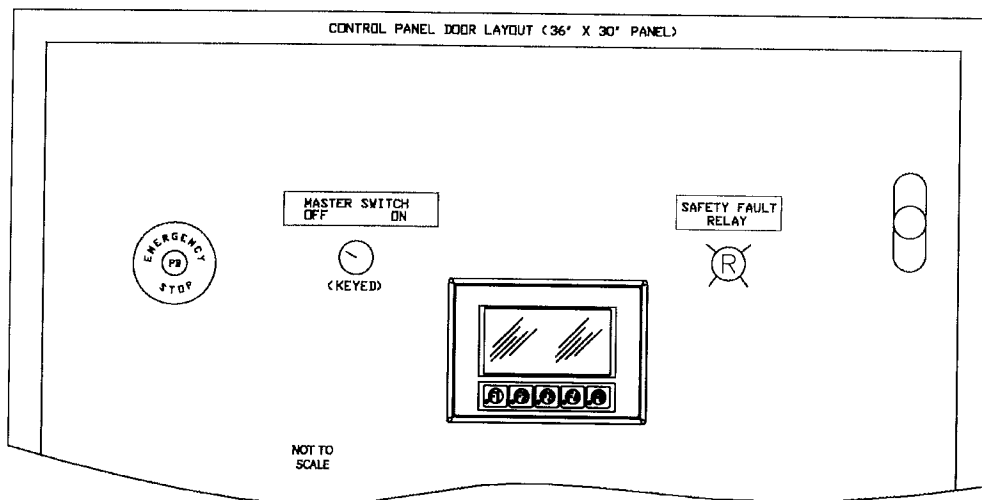


Figure 4-1. Typical Control Panel Layout

Master Control Switch (MCS)

A two- (2) position selector switch is provided on the door of the control panel to turn the rake controls ON or OFF.

OFF Position

The OFF position terminates control circuit power to all rake controls. In this position, both the rake drive and hydraulic hoist drive stop, fixing the rake in a dormant condition (i.e., neither the rake drive nor the hoist drive should operate) and the rake remains in the position it was at termination.

Although the control circuit power is terminated, the three-phase power to all motors is not terminated by the OFF position. Refer to the warnings on the next page and in the safety section – section 2. The three-phase power to the rake must also be locked before servicing or entering the rake bin.

WARNING

The selector switch is not a service disconnect. Lock out electrical power to the control circuit and three-phase power, secure the rake, and /or lower the rake to the rake stops to before entering or servicing the rake.

Before turning the MCS switch to the OFF position, the rake should be lowered to relieve the load from the hoist drive. If the rake cannot be lowered, chains or cables of sufficient strength to support the weight of the rake should be used to secure the rake in position. Never enter the rake bin if the rake is above you. Failure to carefully follow these instructions could result in permanent injury or loss of life.

ON Position

The ON position turns the control circuit on to supply power to the rake control for operation of the rake. If the rake is not being used, the MCS should be turned to the OFF position.

Emergency Stop Push Button (ES)

A normally closed (N.C.) switch is installed in the control circuit prior to the MCS. The red mushroom head of the switch actuator should be pushed in to terminate operation of the rake in case of an emergency.

If the ES button is used, the reason for its use must be determined and corrected before the push button is reset. To reset the ES button, pull out on the red mushroom head. The ES button should *never* be used for normal control of the rake operation.

WARNING

Remote equipment such as transfer screw conveyors (augers) that operate when the rake is in use should be interfaced through the control circuit of the rake to terminate operation of these devices through the emergency stop button in an emergency. The ES button is not a service disconnect. Lock out electrical power to the control circuit and three-phase power before entering or servicing

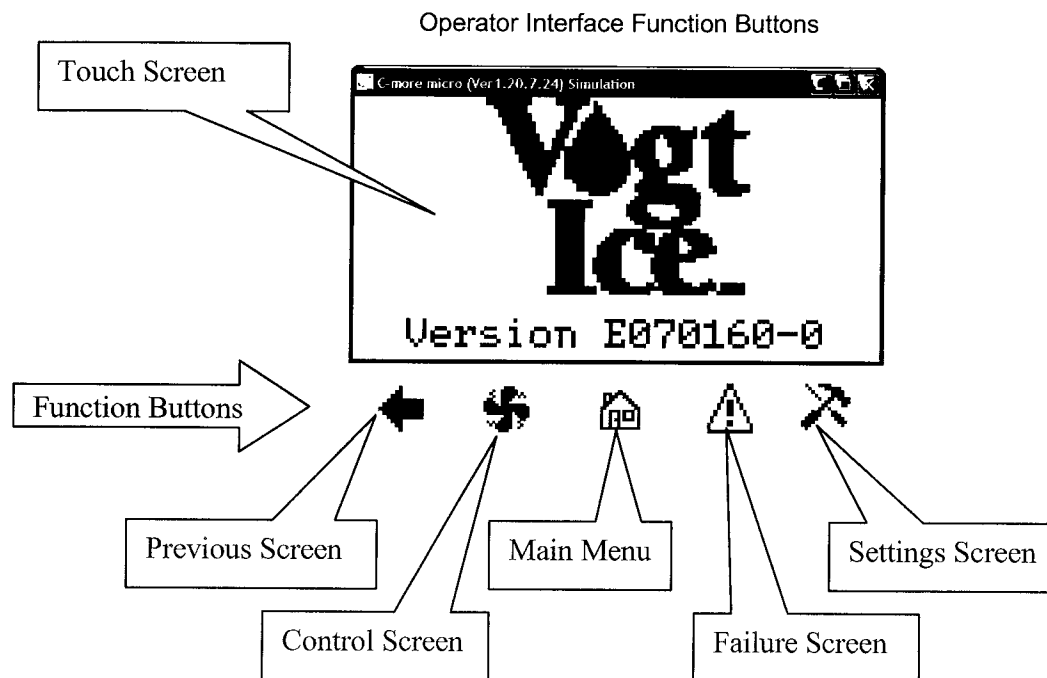
Read Safety Section before installing and operating equipment

the rake. Failure to carefully follow these instructions could result in permanent injury or loss of life.

Operator Interface (OI)

At the heart of the controls is a Programmable Logic Controller (PLC). The PLC utilizes an Operator Interface (OI) for input of timer presets, load control, automatic and manual operation, system feed back, and on-off control. This PLC also controls the rake drive motor and floor screw conveyor through the use of Variable Frequency Drives (VFD). These drives provide feedback to the PLC as to the status of their operating condition. Other sensors and motor starters are also connected to the PLC as well.


The operator interface screen is “touch sensitive” and also has five function buttons located below the screen. The function buttons are shown in the following diagram. These buttons are always available and can be used at anytime and simply provide access to the screens described.

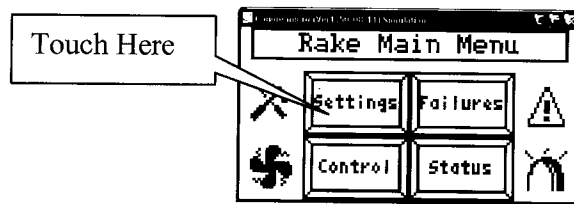


The function buttons allow access to the various setup and control screens stored in the OI. The screens are organized into groups. The groups are Settings, Failures, Control, and Status. The ‘Settings’ screen allows input to the various settings that direct the rake system behaviors. The ‘Failures’ screen allows access to current or previous failure events. The ‘Control’ screen allows access to automatic and manual control of rake functions/operations. The ‘Status’ screen allows access to VFD status indicators.

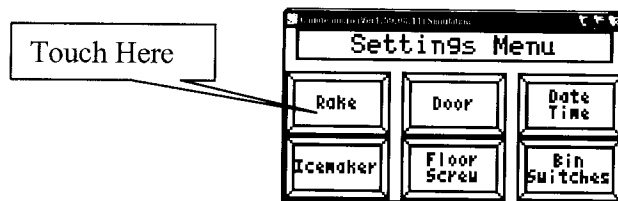
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Quick Start Navigation from the Menu Screen

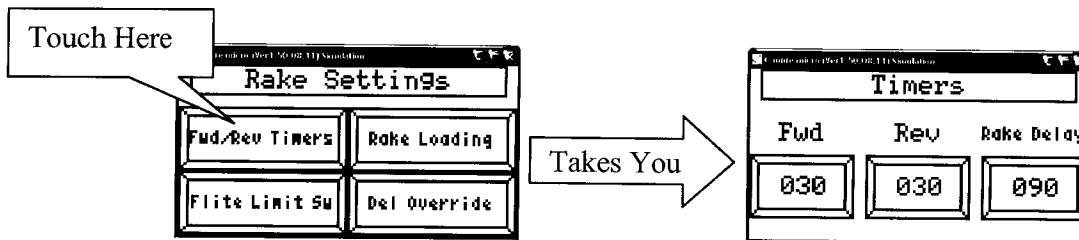
Touching the  (Main Menu) function button will bring up the following screen.



Touching the “Settings” button will change the screen to the “Settings Menu”. The user will then have 6 options: Rake, Icemaker, Door, Floor Screw, Date/Time, and Bin Switches.



Touching the “Rake” button will change the screen to the “Rake Settings” button, providing the user with 4 more choices: Fwd/Rev Timers, Flite Limit Switch, Rake Load Detector, and Delivery Override settings.



Touching the “Fwd/Rev Timers” button will change the screen to the “Timers” screen, allowing the user to change the forward rake time, reverse rake time, and rake delay preset.

All menu navigation follows a similar method; just select a different choice on the settings screen.

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Reference the numbers in the balloons to the table on the following pages for descriptions of the settings.

| Settings Menu | | |
|---------------|-------------|--------------|
| Rake | Door | Date Time |
| Icemaker | Floor Screw | Bin Switches |

| Rake Settings | |
|----------------|--------------|
| Fwd/Rev Timers | Rake Loading |
| Flite Limit Sw | Del Override |

| Icemaker Settings | |
|-------------------|------------|
| Disable | Stop Delay |
| | 060 |

| Door Settings | |
|---------------|------------|
| 08 | Open Time |
| 05 | Pause Time |

| Floor Screw Settings | | | |
|----------------------|-----------|------------|----------------|
| Purge Time | Full Time | Clear Time | Flag Fail Time |
| 060 | 015 | 020 | 240 |

| Current Date/Time | |
|-------------------|----------|
| Change | 00/00/00 |
| Change | 00:00:00 |

| Bin Switches | |
|--------------|----------|
| Hoist Down | Hoist Up |
| 72 | 10 |
| Help | |

| Timers | | |
|--------|-----|------------|
| Fwd | Rev | Rake Delay |
| 030 | 030 | 090 |

| Flite Limit Switch | | |
|--------------------|-----|-----------------|
| Active | 005 | Covered Timer |
| | 018 | Uncovered Timer |

| Rake Load Detector | | |
|--------------------|-----|-----|
| 4.0 | Max | |
| 3.1 | Set | |
| Present AMPs | | 0.0 |

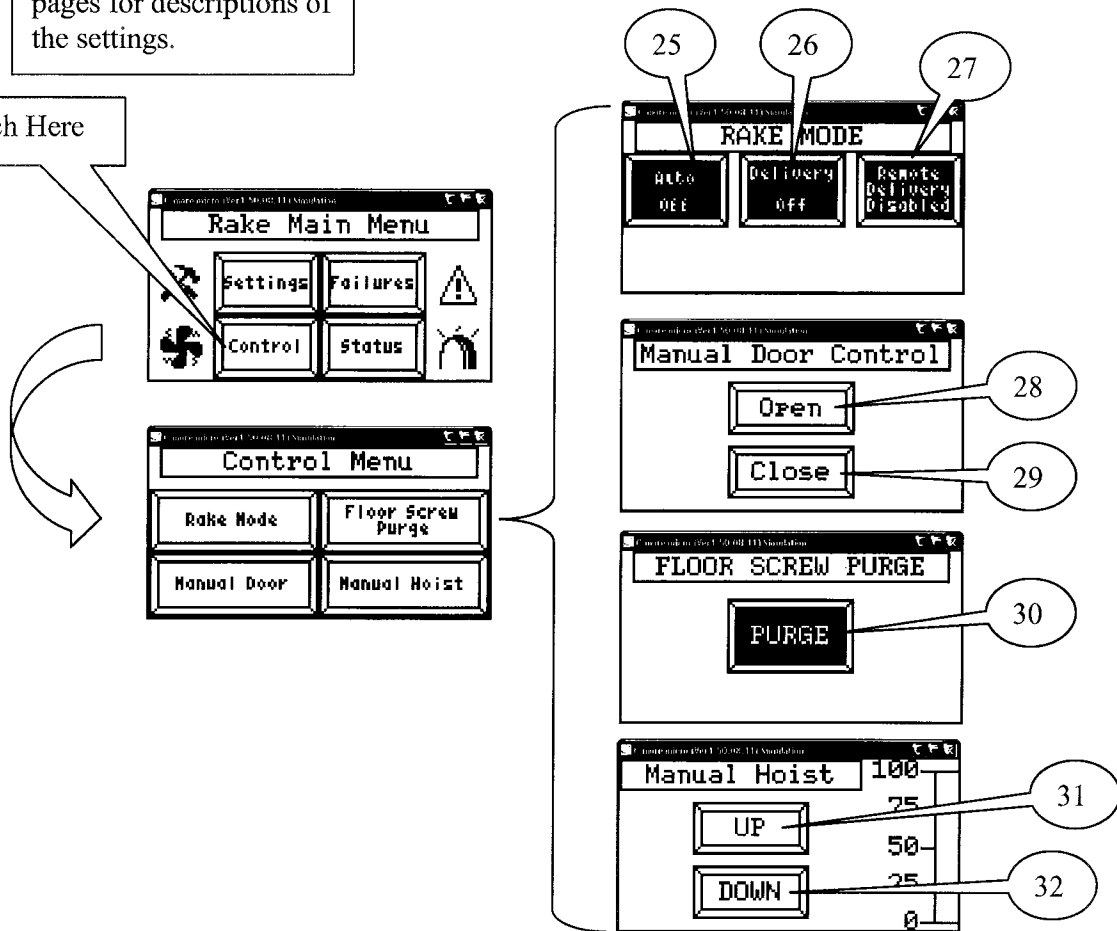
| Delivery Override | |
|-------------------|--------------------------|
| 100 | Delivery Override Preset |

| Change Date | | |
|-------------|--------|------|
| Month | Day | Year |
| 4 | 30 | 8 |
| System Date | Update | |

| Change Time | | |
|-------------|--------|--------|
| Hour (24) | Minute | Second |
| 12 | 34 | 18 |
| System Time | Update | |

Reference the numbers in the balloons to the table on the following pages for descriptions of the settings.

Touch Here



Read Safety Section before installing and operating equipment

| Operator Interface Menu Item Descriptions | | |
|---|-------------------------------------|--|
| | Menu Item | Description |
| 1 | Forward Time Preset | Timer preset for the forward rake direction (toward the door) |
| 2 | Reverse Time Preset | Timer preset for the reverse rake direction (away from the door) |
| 3 | Rake Delay | Timer preset that delays rake operation (leveling mode) upon receiving a defrost/incoming ice signal. This allows ice to start entering the rake before leveling begins. This is done to allow for long screw conveyor runs from the icemaker to the rake. |
| 4 | Covered Time Preset | The rake flite limit switch timer preset that will cause a failure when the switch is covered by a rake flite and not uncovered while the rake drive motor is in operation. An example would be the chain breaking while the flite is on top of the switch. This is typically set for about 3 seconds. |
| 5 | Uncovered Time Preset | The rake flite limit switch timer preset that will cause a failure when the switch is not actuated during rake drive motor operation. An example would be the chain breaking while the flite is not on top of the switch. This is typically set for 15-20 seconds (the time it takes for two rake flites to pass over the switch plus a few seconds) |
| 6 | Enable/Disable (Flite Limit Switch) | Allows for bypass of the rake flite limit switch. Caution should be used when this switch is bypassed-severe rake damage may result with this feature disabled if a problem develops with the drive chain. |
| 7 | Maximum Set Point | Rake drive motor amp draw threshold that causes the rake to lift immediately when the VFD sees this level. |
| 8 | Set Point | Rake drive motor amp draw that must be maintained for a short duration before the rake responds by lifting or descending. |
| 9 | Delivery Override Preset | Timer preset that is used during inactive periods while in the delivery mode. If delivery is inactive for this amount of time while in the delivery mode, the door will close and leveling of the ice can resume. Please note that the floor screw and delivery screws do not purge in this condition. |
| 10 | Enable/Disable (Icemaker) | This setting allows control of the CR1 relay, which allows or prevents the icemaker from starting depending on the rake status. The enable selection will allow the connected icemaker(s) to run if the rake is in the auto mode, not off on a failure, and not full of ice. In the disable position, the connected icemaker will not run regardless of rake status. |
| 11 | Stop Delay (Icemaker) | This preset determines how much additional time the icemaker will run after the bin full indication. The primary reason is to allow the rake to be 'topped off' with ice and also prevent excessive starting and stopping of the icemaker. |
| 12 | Open Time | This preset is part of the door opening sequence to minimize the avalanching of ice if your system is prone to this occurrence. In conjunction with the Pause Time, the door will move open for this number of seconds before pausing, it will then repeat this sequence until the door is fully open. |
| 13 | Pause Time | This preset is part of the door opening sequence to minimize the avalanching of ice if your system is prone to this occurrence. In conjunction with the Open Time, the |

Read Safety Section before installing and operating equipment

| | | |
|----|----------------------------------|---|
| | | door will pause for this number of seconds before moving again, it will then repeat this sequence until the door is fully open. |
| 14 | Purge Time (Floor Screw) | This preset determines how long the floor screw continues to run after delivery has been terminated. |
| 15 | Full Time (Floor Screw) | This preset determines how long the floor screw sensor must be covered in ice before the PLC reacts to the signal. Typically set for 5-15 seconds to prevent false trips. |
| 16 | Clear Time (Floor Screw) | This preset determines how long the floor screw sensor must be clear of ice before the PLC reacts to the signal. Typically set for 5-15 seconds to prevent false clear signals. |
| 17 | Flag Fail Time (Floor Screw) | This preset determines how long the floor screw sensor is covered with ice before it is considered a failure. Typically set for at least 60 seconds. |
| 18 | Change Date | Allows for changing the PLC date. This info is used in recording the Failure History only. Set this to today's date. |
| 19 | Change Time | Allows for changing the PLC time. This info is used in recording the Failure History only. Set this to the current time. |
| 20 | Hoist Up (Bin Switch) | This simply inputs the position of the hoist up limit switch into the PLC. This is used as part of the hoist location calculation to show the vertical location of the rake in the bin. |
| 21 | Hoist Down (Bin Switch) | This simply inputs the position of the hoist down limit switch into the PLC. This is used as part of the hoist location calculation to show the vertical location of the rake in the bin. |
| 22 | Silence (Present Failure) | This silences the audible alarm created by the operator interface while a failure is present. It does not reset the failure. |
| 23 | Clear (Present Failure) | This resets the failure indicated on the operator interface. Personnel authorized and trained in operation of the rake should only do this. |
| 24 | History (Failure) | Displays the time and date of the last three rake failures. |
| 25 | Auto Off/On | Controls the operation of the rake. In the Off position, the rake will not run and icemaker operation is not allowed (if properly wired). In the On position, the icemaker operation is allowed and delivery is allowed. The rake hoist will rise in response to the load on the rake drive motor as ice is delivered into the storage bin. The rake drive motor moves in forward and then the reverse direction on a continuous basis to level the ice as it enters the storage bin. |
| 26 | Delivery On/Off | Starts and stops delivery of the ice. Only allows delivery if the Auto switch (item 25) is turned on. When in the On position, the rake controls automatically change to lower the rake in response to the signal from the VFD, and the rake operates in the forward direction only to remove ice from the storage bin (unload). The hydraulic actuated door system is activated during the opening and closing of the door. |
| 27 | Remote Delivery Disabled/Enabled | This gives the rake panel control over the remote delivery contact. If this is enabled, the remote delivery contact (by others) will allow delivery of ice as needed. If disabled, the remote delivery switch is ignored. |

Read Safety Section before installing and operating equipment

| | | |
|----|----------------------------|---|
| 28 | Open (Manual Door) | Allows the door to be manually opened. Caution should be used when using this as it may allow ice to fall into the floor screw. Using this during automatic operation may cause undesirable results |
| 29 | Close (Manual Door) | Allows the door to be manually closed. Using this during automatic operation may have undesirable results. |
| 30 | Purge (Floor Screw) | Allow the floor screw to be manually purged. The floor screw will stop once the button is released. |
| 31 | Up (Manual Hoist) | Manually raises the rake. Caution should be used in this operation. |
| 32 | Down (Manual Hoist) | Manually lowers the rake. The rake hoist down solenoid (HDS) is energized through the operator interface. In this mode, the rake will lower continuously until either: 1) The rake reaches the rake stops at the bottom of the rake guide or, 2) The rake comes to rest on top of the ice pile in the storage bin, or 3) The button is released. The manual DOWN position should only be used for service or during initial installation to verify operation of the rake. Caution should be used in this operation. |
| 33 | Rake Drive (Status) | Displays Frequency, Amps, RPM and percent loading of the rake drive motor. |
| 34 | Floor Screw Drive (Status) | Displays Frequency, Amps, RPM and percent loading of the floor screw drive motor. |

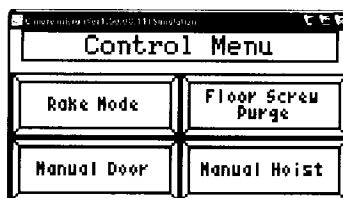
WARNING

The operator interface (OI) is not a service disconnect. Lock out electrical power to the control circuit and three-phase power before entering or servicing the rake. Failure to carefully follow these instructions could result in permanent injury or loss of life.

The Control Menu

WARNING

Before using the Operator Interface, the rake bin should be checked to ensure that neither personnel nor other obstructions are below or above the rake. Never enter the rake bin if the rake is above you. Never enter the rake bin unless the Master Switch is in the OFF position and the electrical power to the control circuit and three-phase power is locked out. Failure to carefully follow these instructions could result in permanent injury or loss of life.

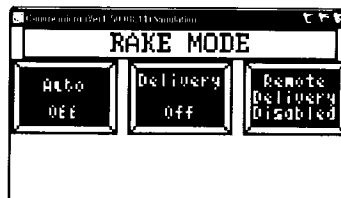


The Control Menu gives the operator access to different rake functions including Rake Mode (for filling and delivery), manual control of the door and hoist, and floor screw purging.

Read Safety Section before installing and operating equipment

The Rake Mode screen

The Rake Mode screen provides controls for filling of the rake with ice and delivery of ice from the rake.



The Auto Mode

When the Auto mode is activated, the controls allow the connected ice machine(s) to run if the following conditions are met: There are no rake failures, the hoist up limit switch is not signaling a full rake bin.

Once the ice machine(s) begins a harvest sequence, a signal is received by the rake bin controls. Once the Rake Delay reaches a preset time, the rake will begin rotating forward and reverse (at a preset interval) to level the incoming ice. As the controls sense an increasing load on the rake drive VFD, the rake hoist is activated to raise the rake enough to result in a lower load on the rake drive VFD. Once the harvest signal is turned off, the rake will continue a forward-reverse cycle and stop after the reverse cycle.

The Delivery Mode

When the Delivery mode is activated, the controls allow the rake door to step through the opening sequence and ice to be delivered from the rake. Delivery will not work unless the Auto mode is on.

Door Opening Sequence-Start of Delivery

The opening sequence is fully adjustable from the Door Settings screen mentioned earlier in this section. The Open Time and Pause Time work together to 'step' the position of the door until it is fully open. The Open Time turns the hydraulic system on for a preset number of seconds followed by the Pause Time preset. This cycle repeats until the door is fully open. If the Floor Screw Conveyor sensor detects the conveyor is full or overloaded, the door opening sequence is halted until the floor screw is cleared. This is done to help minimize overloading the floor screw in the event of an avalanche of ice upon the initial door opening. If no door pause is desired, set Pause Time to zero seconds. Providing the Floor Screw Conveyor is not full, the rake will run forward during the door opening sequence.

Delivery Sequence

During the door opening sequence and once the door is fully open, the rake controls will move ice towards the door and begin to fill the screw conveyor with ice. During this sequence, the controls monitor the Rake Drive VFD load and compare it to the Rake Load Detector set point and control the rake hoist movement up and down. This provides a steady flow of ice from the rake.

Screw Conveyor Overload during Delivery

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If the floor screw conveyor flag switch detects an overload of the conveyor, the rake drive will stop moving the rake forward to allow the conveyor to clear. Once the conveyor overload has cleared, rake drive motion will resume. If an ice maker harvest signal is received during this pause, the rake will run in reverse only to allow the incoming ice to be leveled without adding additional ice to the already overloaded screw conveyor. If the screw conveyor is unable to clear the sensed overload in the Flag Fail Time preset, this will result in a failure of the delivery system and will shut down the delivery side of the rake, still allowing the rake to fill.

Surge Bin Full-Pause

If the Surge Bin Level Switch (SBLS) detects a high level during the delivery process, the floor screw conveyor and the rake drive will pause to allow the full surge bin to clear. If the pause lasts longer than the length of the "Delivery Override" timer preset, the door will attempt to close and the rake will be allowed to run in forward and reverse to level the incoming ice from the icemaker(s). Once the SBLS is clear for three seconds, delivery will resume. It is important to remember that after the Delivery Override timer has timed out, ice still remains in the conveyors at this point and should be purged if all delivery is complete.

Door Closing Sequence-Delivery Complete

Once the delivery switch is turned off, the forward motion of the rake will stop and the door will attempt to close. Occasionally during delivery, an ice build up may be present on the Floor Screw Conveyor flange (the resting place for the door in the closed position) preventing it from fully closing. To overcome this, the door will attempt to close up to three times, each time coming down as far as it can to dislodge any ice in its path. If the door is unable to close, it will shut down the entire delivery system as a Door Close Failure. During the door close sequence, the Floor Screw Conveyor will continue to run allowing the system to purge.

Remote Delivery Enable switch

The Remote Delivery Enable switch is used in conjunction with a hard wired delivery switch wired to the control panel. The Enable option on the Operator Interface will allow a remotely wired delivery switch to start and stop delivery. The Disable option will prevent the remote switch from starting or stopping delivery.

Manual Rake Hoist control using the Operator Interface

WARNING

Before using the Manual Hoist function with the Operator Interface, the rake bin should be checked to ensure that neither personnel nor other obstructions are below or above the rake. Never enter the rake bin if the rake is above you. Never enter the rake bin unless the Master Switch is in the OFF position and the electrical power to the control circuit and three-phase power is locked out. Failure to carefully follow these instructions could result in permanent injury or loss of life.

CAUTION

Before using the Manual Hoist controls, ensure the hoist cable is set up correctly to prevent damage to the rake as limit switches are ignored during manual hoist control.



Manual Up

1. To raise the rake, press the Up button on the Manual Hoist screen of the operator interface. This energizes the Hoist Up solenoid and the Hydraulic Pump motor contactor.
2. The upward travel will stop if:
 - a. The button is released.
 - b. The end of the cylinder travel is reached.
 - c. The overload on the hydraulic pump overloads trip.

Manual Down

1. To lower the rake, press the Down button on the Manual Hoist screen of the operator interface. This energizes the Hoist Down Solenoid and allows the hydraulic system to lower the rake via gravity. The hydraulic pump does not operate during a hoist down command.
2. The downward travel will stop if:
 - a. The button is released. The Hoist Down Solenoid is de-energized and downward movement will stop.
 - b. The rake comes into contact with the ice pile or the Rake Stops located on the rake guides.

Caution:

Never try to raise a buried rake with the hoist. This places an undue strain on components of the rake, hoist, or the bin structure. Severe damage to equipment and/or injury to personnel can result from such an attempt. Remove ice to uncover the rake members before attempting to raise the rake. Lock out all power and

Read Safety Section before installing and operating equipment

controls before entering rake. Failure to carefully follow these instructions could result in permanent injury or loss of life.

The UP position is typically used for service or to verify operation of the rake during initial start-up. Do not use it for normal operation of the system.

WARNING

Before using the Manual Up rake function, check the rake bin to ensure that neither personnel nor other obstructions are above the rake. Never enter the rake bin if the rake is above you. Never enter the rake bin with the hoist moving.

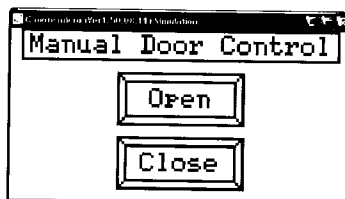
Manual Door Control using the Operator Interface

WARNING

Before using the Manual Door Control function with the Operator Interface, the rake door should be checked to ensure that neither personnel nor other obstructions are below, above or near the door of the rake. Never be on the door while it is in motion. Never enter the rake bin unless the Master Switch is in the OFF position and the electrical power to the control circuit and three-phase power is locked out. Failure to carefully follow these instructions could result in permanent injury or loss of life.

CAUTION

Before using the Manual Door controls, ensure the door cable is set up correctly to prevent damage to the rake as limit switches are ignored during manual door control.



Manual Open

1. To raise the door, press the Open button on the Manual Door Control screen of the operator interface. This energizes the Door Open solenoid and the Hydraulic Pump motor contactor.
2. The upward travel will stop if:
 - a. The button is released.
 - b. The end of the cylinder travel is reached.
 - c. The overload on the hydraulic pump overloads trip.

Manual Close

1. To close the door, press the Close button on the Manual Door control screen of the operator interface. This energizes the Door Close Solenoid and allows the hydraulic system to lower the door via gravity. The hydraulic pump does not operate during a door close command.
2. The downward travel will stop if:
 - a. The button is released. The Door Close Solenoid is de-energized and downward movement will stop.
 - b. The door comes into contact with the ice pile or the floor screw conveyor lip.

Read Safety Section before installing, operating, or servicing equipment

TURBO[®]

REFRIGERATING

CB Series Rake Manual Installation, Operation & Maintenance

TROUBLE-SHOOTING

This section lists common problems and suggests solutions. Many problems are easy to solve if you know what caused them. If your problem is not covered in this section, contact Turbo Refrigerating at: **1-940-387-4301 Ask for the Service Department.** The following pages describe problems you might encounter and provide diagnostic instructions and solutions.

WARNING

All electrical work should be done by a qualified electrician. Failure to carefully follow these instructions could result in permanent injury or loss of life.

PROBLEMS AND SOLUTIONS

| Problem | Causes | Solutions |
|--|---|--|
| Rake rises above ice surface during loading. | “Hoist Up” timer setting is too long. Hoist UP drive stays on too long. | Electromechanical versions: Adjust hoist UP cam to reduce length of time hoist UP drive is energized. This will reduce the hoist up travel. and / or The frequency of the hoist UP sequence occurs can also be reduced by changing the frequency setting on the hoist up timer to a longer time interval between hoist up operation. |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|---|--|--|
| | | Change setting on hoist up timer to reduce the duration (time hoist drive is ON) |
| | | Change the frequency to reduce how often the hoist up timer sequence occurs. |
| | | PLC versions: |
| | | Models with load detector: Polarity of load detector is wrong - Reverse X1 and X2 connections. |
| | | Minimum setting of load detector too low - Increase MIN setting. |
| The rake does not descend fast enough during unloading. | Hoist frequency and / or duration timers not properly set. | Electromechanical versions: Adjust the hoist DOWN timer cam to increase the détente time of the hoist DOWN solenoid valve (HDS). This will increase the length of time the hoist DOWN solenoid valve is "ON" is (energized). |
| | | PLC versions: Controlled by the signal from the load detector or VFD. Change preset on load detector or VFD to increase loading percentage before signal is input to PLC. Reference Load Detector and VFD manual. |
| | | Models with load detector: Polarity of load detector is wrong - Reverse X1 and X2 connections. |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|--|---|--|
| | Load detector or VFD settings incorrect causing rake hoist down to pause too frequently | Minimum setting too low - Increase MIN setting on load detector. |
| Ice is not leveled between harvest cycles. | Rake drive forward and reverse frequency and/or duration are too short to properly level ice. | <p>Electromechanical versions:</p> <p>Rake drive timer TM1 is not properly adjusted. Adjust setting (gap) on "Rake Drive Forward and Reverse" timer cam. Refer to section 4 - Operating Instructions.</p> <p>PLC versions:</p> <p>Presets for rake forward and /or rake reverse are too short to allow proper travel of the rake flites in both directions.</p> <ul style="list-style-type: none"> • Increase preset of forward and/or reverse. • Observe operation and repeat if necessary. |
| | Hoist up timer is raising the rake too frequently or for too long during each up sequence | <p>Electromechanical versions:</p> <p>Rake hoist "UP" timer is not properly adjusted.</p> <ul style="list-style-type: none"> • Adjust setting (gap) on "Rake UP" timer cam. Refer to section 4 - Operating Instructions. <p>PLC versions:</p> <p>Presets for rake hoist UP are too long allowing the hoist to operate too long.</p> <p>Decrease preset of hoist up timer. Observe operation and repeat if necessary.</p> |
| | Load detector setting are too low preventing the rake from getting into the ice to level it | <p>Models with load detectors:</p> <p>Hoist up is controlled by the signal from the load detector or VFD.</p> |

| Problem | Causes | Solutions |
|--|---|--|
| Rake becomes embedded in ice during loading. | <p>“Hoist UP” timer setting is too short. Hoist UP drive does not stay energized long enough.</p> | <p>load detector or VFD.</p> <ul style="list-style-type: none"> • Increase the MAX setting of the load percentage on the load detector or VFD and observe when rake drive is on. This allows heavier loading of the rake flites before the input to the PLC energizes the hoist UP drive to reduce the rake drive motor loading (power). <p>Electromechanical versions: Adjust hoist UP cam to increase the length of time hoist UP drive is energized. This will increase the hoist up travel.</p> <p>and / or</p> <p>The frequency of the hoist UP sequence occurs can also be increased by changing the frequency setting on the hoist up timer to a shorter time interval between hoist up operation.</p> <p>PLC versions: Controlled by the signal from the load detector or VFD. Change preset on load detector or VFD to decrease loading percentage before signal is input to PLC. Reference Load Detector and VFD manual.</p> <ul style="list-style-type: none"> • Change preset on hoist up in PLC logic. Reference PLC manual. <p>Models with load detector: Polarity of load detector is wrong - Reverse X1 and X2 connections.</p> |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|---------|--|--|
| | | Minimum setting too high - Decrease MIN setting on load detector. This energizes the hoist up starter with a lighter load on the rake flites so the hoist goes up more frequently. |
| | Ice production /delivery into the bin exceeds the rake settings. | Electromechanical versions: Increase the frequency and duration settings for the hoist up drive. If the production capacity can vary over a wide range through operation of a number of different icemakers it may be necessary to add additional UP timers or reset the existing UP timer settings for each set of production conditions. |
| | | PLC versions: Hoist speed is controlled by the signal from the load detector or VFD. Change preset on load detector or VFD to decrease loading percentage before signal is input to PLC. This will increase the up travel by raising the rake under lighter load conditions. Reference Load Detector and VFD manual. <ul style="list-style-type: none">• Change preset on hoist up in PLC logic.• Reference PLC manual. |
| | | Models with load detector: Polarity of load detector is wrong - Reverse X1 and X2 connections. |
| | | Minimum setting too high - Decrease MIN setting on load detector. This energizes the hoist up starter with a lighter load on the rake flites so the hoist goes up more frequently. |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|--------------------------|---|--|
| Rake hoist does not run. | <p>Hoist travel is restricted</p> <p>Rake function selector switch is in OFF position.</p> <p>Master control switch (MCS) is OFF</p> <p>Rake drive or hoist drive motor magnetic starter overloads are tripped.</p> <p>Power to controls and/or three-phase is off.</p> <p>Emergency stop button has been pushed NOTE: If jumper has been removed and the remote R5 relay is used, the emergency7 stop function can be done from the control panel or a remote location. Check both if applicable.</p> <p>Safety failure relay has tripped.</p> | <p>Check rake lifting beams, rake guides, hoist cylinder, lifting cables, and pulley for restrictions in movement.</p> <p>Turn to AUTO position.</p> <p>Turn to ON position</p> <p>Check for source of problem, correct problem, and reset.</p> <p>Check circuit breakers, disconnects, and fuses.</p> <p>Determine the reason the ES button was pushed and correct the problem. Notify all personnel ES is being reset and verify no one is inside the bin before reset is changed.</p> <p>The safety failure trips for the following reasons:</p> <ul style="list-style-type: none"> • Motor overload trip • Bin door failure • Rake drive failure • Floor screw overload – “Flag switch” <p>Determine the cause of the safety failure trip and reset by turning the MCS (Master) to the OFF position and then back to ON. Observe rake operation to ensure everything is working properly.</p> <p>Since there is no delivery into the rake or demand for ice out of the rake, the rake does not operate even though the switch is in the AUTO</p> |
| | <p>The icemakers are OFF and there is no delivery to the rake, and the delivery switch is OFF.</p> | <p>properly.</p> <p>Since there is no delivery into the rake or demand for ice out of the rake, the rake does not operate even though the switch is in the AUTO</p> |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|---|---|---|
| | Bin "FULL" limit switch tripped. | operate even though the switch is in the AUTO position. Unless the Delivery Switch (DS) is ON the rake will stop and a set of dry contacts in the icemaker circuit will terminate operation of the icemaker. |
| | Bin "EMPTY" limit switch tripped. (Option) | The rake is empty and the icemakers are OFF. The hoist stops unless the icemakers are ON. Turn the icemakers ON to resume operation. |
| No control voltage. | 10 amp control fuse(s) tripped. | Check for loose wiring, short circuits, and bad relay or timer contacts. Replace fuse(s) after source of problem is determined. |
| | Emergency stop button utilized. | Check with all operating personnel for reason emergency stop was used. Correct source of problem and reset emergency stop button. |
| Ice pile develops at front and/or rear of bin. Note: To protect the quality of the ice in the bin, the forward and reverse run times should be kept to the minimum required to level the ice. | Improper adjustment of rake drive timer setting. Rake is running too long in reverse mode and not enough in forward or vice versa. | Adjustment of forward and reverse settings are determined by the ice entry point. If ice enters in the middle of the bin, the forward and reverse settings will be the same. If ice enters at the rear, the forward setting will be longer than the reverse setting. The opposite is true if ice enters at the front of the rake. Adjust the forward and reverse timer cam to match the ice entry point. Observe operation and continue to adjust until the ice is leveled without creating piles at either end or voids on the side. |
| | Models with load detectors automatically raise or lower the rake in response to the rake load. | Verify setting of load detector or VFD. |

| Problem | Causes | Solutions |
|--|--|---|
| Rake hoist and rake drive both inoperative. | Four position selector switch in OFF position. | Place selector switch in AUTO position (older models have a LOAD or UNLOAD switch). |
| <p>WARNING Disconnect and lock out power to rake before entering bin. Failure to carefully follow these instructions could result in permanent injury or loss of life.</p> <p>IMPORTANT Never try to raise a buried rake with the hoist - this places an undue strain on components of the rake, hoist, or the building structure. Severe damage to equipment and/or injury to personnel can result from such an attempt. After locking out power to the rake, remove ice to uncover the rake members before attempting to raise the rake.</p> | <p>Three-phase power off or locked out.</p> | <p>If delivery switch is in the ON (UNLOAD) position and the floor screw conveyor overloads are tripped, it will also prevent the hoist from lowering and prevent rake operation. See floor screw failure below.</p> <p>Verify that service or maintenance personnel are not performing service work, or are inside rake before returning power to system. Verify power input, disconnects, fuses, and circuit breaker position. Check for loose terminals or lugs.</p> <p>Determine cause of overload and replace fuse(s) if applicable.</p> |
| | Floor screw limit switch is tripped. | <p>Verify that the floor screw limit switch or proximity sensor is functioning properly. If the floor screw is overloaded with ice, clear the floor and determine the cause of the overload. Determine the cause of the floor screw conveyor overload and correct. Reset the magnetic starter overload relay.</p> <p>Check the LS-3 (limit switch) located above the floor screw conveyor. Check electrical connections and for physical interference preventing close of limit switch.</p> |

WARNING

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|---------|---------------------------|---|
| | | Never inspect or attempt to dislodge obstructions in the floor screw with the power on. Refer to section 2 - Safety for proper lock out procedures and conveyor manufacturer's instructions and warnings. Failure to carefully follow these instructions could result in permanent injury or loss of life. |
| | Door open / close failure | <p>A signal indicating the door position (open or closed) is required before the rake drive or rake hoist will operate. Test the door open (DOLS) and door close (DCLS) limit switch for proper operation.</p> <p>Check the position of the door to ensure that it is either fully closed causing the DCLS to close or fully open causing the DOLS to close. The system will not operate with the door in between the limit switch positions.</p> <p>Retaining wall not in proper position.</p> <p>Limit switch arm not properly adjusted. If door is opening and closing properly but the limit switch does not trip, adjust the limit switch arm. Contacts of limit switch bad or burned. Replace limit switch.</p> <p>Retainer wall is open. Close the retainer wall safety cover and resume operation.</p> <p>Replace the safety cover and make sure the limit switch or proximity sensor is in place and working properly.</p> |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|--|--|---|
| | Control circuit fuse(s) tripped. | Verify that service or maintenance personnel are not performing service work, or are inside rake before returning power to system. Verify power input, disconnects, fuses, and circuit breaker position. Check for loose terminals or lugs. |
| | | Determine cause of overload and replace fuse(s) if applicable. |
| | Emergency stop button tripped. | Determine the reason the emergency stop button was pushed. Correct problem and reset emergency stop button. |
| Rake drive does not operate. | Motor overload protection tripped. | Determine the cause of the overload and then reset the starter overload relay. Check for obstruction of rake flites (rake embedded in ice, etc.). Lock out power before entering rake bin. |
| WARNING Never get under the rake. Failure to carefully follow these instructions could result in permanent injury or loss of life. | Drive chain off of rake drive. | Check for broken or damaged chain links or sprocket teeth. Check adjustment of chain tension. After readjusting, make a visual inspection of the rake drive operation from the outside of the rake, in the forward and reverse modes. Observe rake flite attachment and travel on rake girders for misalignment or excessive drag. Check rake wear pads. Replace wear pads if excessive wear indicated. |
| | Rake flite chain off sprockets due to improper adjustment or excessive wear. | Check condition of rake chain in general. Check links and K-1 attachments in particular. Check the sprockets on both the drive and idler shafts for wear and proper alignment (centerline to |
| Trouble-Shooting | 5/01 Turbo Refrigerating 5-10 | |

Read Safety Section before installing, operating, or servicing equipment

| Problem | Causes | Solutions |
|---------|---|---|
| | | centerline). Check locking collars for loose bolts and sheared roll pins. Refer to section 3 - Installation & Assembly Requirements for instructions on checking the diagonal squareness of the rake and adjust cross brace rods as required. Tighten all locking (jam) nuts on cross brace rods. |
| | | Chain with excessive wear should be replaced immediately to prevent damage to other components. |
| | | Notes: A rake drive motor soft start control is available to reduce the starting torque and shock on the rake drive and rake flite chain. It provides for long chain life and smooth operation. |
| | Return bends on the end of the rake girders are not properly aligned, causing the rake flite to make contact with the return bend. Can cause overload trip of rake drive. | Adjust or check all return bend alignments. Check for loose bolts. |
| | Overloads on hoist drive tripped. Rake becomes embedded in ice. | Determine cause of hoist drive failure (obstruction of lifting mechanism, ice build-up on flites, ice bridging, etc.). Reset overloads on magnetic starter overload relay. |
| | The rake has encountered hard ice or a foreign object. | The load settings setting should be reduced and the hard ice removed from the bin before the rake can be returned to normal operation. |
| | | Note: |

| Problem | Causes | Solutions |
|--|---|---|
| | | Do not try to remove solid ice (that can form at the bottom of the bin) with the rake. If necessary, empty the rake bin and raise the room temperature to approximately 40°F to melt the ice. |
| | Ice build-up on rake flites, lifting beams, or girders resulting in interference with the rake flite travel. | Eliminate the source of the condensate or water leakage into the rake bin causing the ice build-up. The most common source is the ice entry point in the rake storage area due to temperature variation at the ice entry point. |
| | Ice build-up behind the K-1 attachment resulting from improper ice entry into the bin (i.e., not along centerline of rake) or improper adjustment of hoist settings causing the rake to become embedded in the ice. | Add a deflector to divert the ice entry to the center of the rake and away from the lifting beam and girders. Adjust the setting of the hoist timer to obtain a steady, even loading of the rake flites. |
| NOTE: 1. Later models (1988) have a relief hole between the K-1 and rake flite to prevent ice build-up. | | |
| Hoist lowers when the rake is off | Manual bypass valve on the hydraulic manifold block is open. | Close the manual bypass valve. |
| | Seals on hydraulic cylinder are leaking. | Replace seals. |

IMPORTANT

In most installations, the rake has the capacity to deliver more ice than the other delivery components. Caution should be used not to overload other components.

Helpful Hints

In the event of extended (greater than 48 hours) interruption of refrigeration in a refrigerated bin, it is possible that the ice pile will begin to bridge together. The rake may become frozen in position in the ice. TURBO recommends raising the rake until the teeth of the flites are just above the ice surface and then to reduce the rake hoist settings while the hard, frozen ice is removed. It is possible that some very large blocks of ice, one foot or more in size, will be removed by the rake. These large pieces can cause damage to the conveying equipment. Therefore, it is necessary to exercise caution until the ice has returned to a free flowing form.

To prevent ice from bridging and becoming hard at the bottom, four (4) inch PVC pipe can be run along the length of the rake from the front to the rear to form a false floor through which cool air can be circulated. Reference Section Three – Installation for additional information or contact TURBO at 940/387-4301.



Technical Bulletin 0601
September 2006

CB and Automatic Rakes
Rake Pad Contamination-Black Residue

Turbo Refrigerating, LLC
P.O. Box 396
Denton, Texas 76202-396
Telephone: 940-442-5902
Fax: 940-382-0364

Products / Models Affected

All CB and Automatic rake. Includes 3" by 3" and 3" by 5" rake flite pads.

Description

All rake flites come with factory installed rake flite pads – wear pads. The pads are constructed of UHMW (ultra high density polyethylene). All rake flite have four (4) pads mounted on each rake flite; upper and lower on each end of the flite. These pads ride on the rake girders to support the rake flite. Later model rakes also have an additional four (4) “outrigger” pads to maintain the position of the rake flite as it passes through the ice – resists the rotating up of the flite and ensures more even wear of the rake pads. The outriggers pads are the same size and material of construction as the rake flite pads.

Issue

During the start-up period a black residue appears on the girder liners. Since the rake pads “wipe” the girder liner surface as the flites travel in the forward and reverse direction, any residue on the rake girder liner will be concentrated and forms into small black specks.

Above freezing rake systems: Black residue is typical worse in above freezing ice storage rooms due to the accumulation of moisture from the ice on the girder liners. This results in a “wet lapping” that accelerates the formation of the residue.

Below freezing rake systems: In room that are maintained well below the freeze point (typically 25 degrees F; -3.9 degrees C) moisture on the rake girders is reduced and in most cases freezes on the liner and the amount of residue is reduced.

The residue that collects on the girder liner is the result of contaminants on the girder liner. During normal installation and start-up the rake girder liners are exposed to a number of sources that can contaminate the girder liner including outdoor storage prior to installation, handling during installation, grinding and welding work performed in close proximity of the rake, tools laid on the liners during installation to name a few. All of these contaminants create a layer of “dirt” on the girder liner that must be removed prior to operation. If the “dirt” layer is not removed the rake pads act as a mixer to combine the moisture and “dirt” to form the small black specks that collect on the girder liner.

Corrective Action

After the rake system has been installed the girder liners should be thoroughly cleaned to remove the "dirt" that has collected. Several methods may be used. The following procedure has proven successful and can be used:

1. Once the rake installation and all construction have been completed the interior of the rake system should be swept clean and all debris removed.
2. Next use a pressure washer or garden hose to wash down all the interior surfaces including:
 - a. Floor
 - b. Rake bin door interior panels
 - c. Bin liner walls.
 - d. Rake assembly
 - e. Floor screw
3. Obtain a small garden type pump sprayer.
4. Fill the sprayer with a 50/50 mixture of Simple Green degreasing solution and water. Totally wet both the top and bottom girder liners with the mixture.
5. Allow the solution to sit for 5-10 minutes but keep the surfaces wetted during this time period.
6. Using a pressure washer or garden hose wash down all the girder liners to remove the cleaning solution.
7. Wipe the surfaces dry after rinsing.
8. If the rags used to wipe the girders down are heavily soiled after use the cleaning process should be repeated.

Using the above procedure will remove most of the residue that can cause the "black" residue that can build up on the girder liner. In some cases, some "black" will still occur especially on systems in above freezing storage where moisture is always present on the girder liners. The second step in the start-up process in these cases is to periodically clean the girder liners during the first days/weeks of operation until the residue is no longer a problem. Since ice is typically in the ice rake at this time the Simple Green solution should not be used. The procedure in this case is:

1. In place of the Simple Green use a 50/50 mixture of water and isopropyl alcohol.
2. Using clean cotton rags soak the rags with the solution and wipe the girder liners down. Note: if the rake is at the bottom of the bin and the ice under the rake will be disposed of, a small hand spray bottle can be used to saturate the girder liner and then wiped off with the clean cotton rag.
3. Repeat until the residue has been removed.

This procedure should be used periodically or anytime residue appears. Even when the girder liners are clean some residue may be seen on the rake pads. This is typically embedded in the surface of the pad and does not cause a problem. In extreme cases such as rake systems with a very wet ice, it may be necessary to replace the rake pads used on the original installation.

Additional Information

For additional information contact:

Turbo Refrigerating, LLC

Parts Department – 940-442-5906

or

Aftermarket Department – 940-442-5902

Typically Asked Questions

1. Can I clean the pads after the rake has been in use?

If the rake girders were not cleaned before start-up and "black" specks appears you can still clean the girders but it will take longer to completely clear up the problem. Unless the rake bin can be completely emptied it will be necessary to use the alcohol cleaning solution instead of the Simple Green. If possible use the Simple Green since it is much faster and more effective in cleaning the stainless steel girder liners. The cleaning process is also faster if the rake storage area can be above freezing. The process may require several weekly cleanings to get rid of the black specks. In some cases it may be necessary to replace the rake pads — debris left on the girder become embedded in the poly rake pads and is difficult to remove.

2. Is there any other ways to protect the girder liner and rake pads?

Although the rake pads are made of a UV stabilized material, replacement pads should not be stored in an area exposed to sunlight. Pads that are exposed to sunlight tend to produce more of the "black" residue.

3. Should the girder liner be lubricated?

No. In general even USDA approved lubricating sprays tend to gum up and do not work well with the UHMW pads. In below freezing storage room's water can be sprayed on the girders to form a thin layer of ice that helps protect the liner and eliminates the build up of residue.

4. Does the rake run time sequence affect the problem?

In the load mode, the standard rake controls provided by TURBO are set up to run the rake forward and reverse for a fixed time interval each time an icemaker section harvests. The time the rake runs in forward and reverse is field adjustable and should be set to the minimum run time that keeps the ice pile level. Excessive run time not only produces more snow by over-raking the ice, it increases the wear on the pads.

Keys to eliminating contamination:

- **Thoroughly clean the rake bin interior including the girder liner after installation.**
- **Keep it clean by periodic cleaning.**



CB Series Rake Manual Installation, Operation & Maintenance

MAINTENANCE

To help you get the best performance from your rake system, follow the maintenance instructions listed below. If you have questions concerning the maintenance of your equipment, contact:

**Turbo Refrigerating
Service Department
1000 West Ormsby Ave, Suite 19
Louisville, KY 40210
Phone: 502-635-3000
Fax: 502-635-3024**

Daily Inspections

Inspect the position of the rake and ice level at least twice a shift to determine that the settings of the hoist timer and load detector are proper.

At the start of the unloading operation, observe the ice door opening until a stable delivery of ice is established. It may be necessary to partially open the door to start delivery to avoid ice avalanching and overloading of the floor screw. Once delivery (ice flow) is established the door can be opened further for the remainder of the delivery cycle.

IMPORTANT

Failure to observe these procedures may result in overloading or burying the floor screw with the result that the ice may bridge over the floor screw or the floor screw may be so greatly overloaded with ice that it will be unable to start.

Note:

When the door is opened, there may be loose ice that will run freely into the floor screw for a few minutes. The door should be opened slowly to control this flow before the rake is left in automatic operation.

Inspect to see that the small holes in the rake flite (at the point where the chains are attached to the flites) are free of any ice build-up.

At the end of the operating day, the door should be closed and observed to see that a stable pile of ice is being built against the door.

After Initial Ten Hours of Operation

Retighten all bolts.

Realign and square the rake.

Check sprocket alignment.

Check all cables and cable clamps.

After Initial Fifty Hours of Operation

Retighten all bolts.

Have a qualified electrician check the control panel for loose connections or loose lugs on the magnetic starter.

Weekly Inspections

Check speed reducer lubrication –hoist drive and rake drive.

Check reducer for signs of oil leakage.

Check wear pads on rake for excessive or uneven wear. Replace when 1/16" of pad remains above screw heads.

Check set screws and bolts on sprockets for tightness.

Check chains on flites and rake drive for tension and wear.

Check alignment of idler and drive sprockets.

Every Two Weeks

Empty the rake bin (lower the rake to the extreme low position, removing all usable ice) as often as possible and at least once every six weeks.

With non-TURBO ice or wet ice, more frequent cleaning may be required.

Every Six Weeks

Grease all grease fittings on the rake idler sprockets, drive and idler shaft bearings, and all lifting pulleys.

Inspect the flite attachments (flange and bolts).

PLC Systems – Counter Addresses and Presets

| Function | Counter | Automatic (Hydraulic) Bin Door |
|--------------------------|---------|-----------------------------------|
| Rake forward Timer | C600 | 60 seconds |
| Rake Reverse Timer | C601 | 60 seconds |
| Floor Screw Surge Timer | C605 | 30 seconds |
| Delivery Override Timer | C607 | 120 seconds |
| Rake Flite Failure Timer | C611 | 15 seconds |
| Door Failure timer | C613 | 30 seconds |
| Initial Door Open Timer | C617 | 2 seconds |
| Door Pause Timer | C620 | 120 seconds |

NOTE: The counters and presets shown are typical for standard rakes. Since TURBO provides optional programming for special applications the actual counters and presets are shown in the ladder logic cover page provided with the rake when it is shipped. A copy of the ladder logic is also located in the pocket inside the rake control panel.

Table 6-1 Rake Lubrication Schedule

| Part | Type of Lubricant | Frequency |
|---|---|---|
| Rake Drive Motor | Note 2 | Note 2 |
| Rake Drive Reducer | Texaco Lubriplate #8 or equivalent | Change first week and every 6 months |
| Rake Shaft Bearings Rake Idler Sprockets | Texaco Lubriplate #FML-2 or equivalent | Every 6 weeks – do not over grease |

1. All lubricants inside rake bin are food grade.
2. Motor Lubrication – gear reducers

The motor is equipped with double-shield ball bearings having sufficient grease to last indefinitely under normal service. When the motor is used constantly in dirty, wet, or corrosive atmospheres, add 1/4 ounce of grease per bearing every 3 months. Use a good quality, rust inhibited, polyester based grease, such as Chevron SR1 or as indicated by the motor manufacturer.

When greasing the bearings, keep all dirt out of the area. Wipe the fittings completely clean and use clean equipment. More bearing failures are caused by dirt introduced during greasing than from insufficient grease.

3. The blower end bearings of 143T and 145T motors are sealed bearings and need no greasing.

Read Safety Section before installing, operating, or servicing equipment

Table 6-2 Sample Daily Ice Plant Log Sheet

Date:

| | Ice Depth | Rake Pads Visual Check | Rake Drive Chain | Flare Chain | Vault Temperature | Door Position | Icemaker | | Compressor Oil Pressure | Defrost Water Temperature | | | Defrost Water Pressure | | | Ambient Temperature |
|-----------------------|--------------|---------------------------|---------------------|----------------|----------------------|------------------|------------------|---------------------|----------------------------|---------------------------------|---|---|------------------------------|---|---|------------------------|
| | | | | | | | Head Pressure | Suction Pressure | | 1 | 2 | 3 | 1 | 2 | 3 | |
| First Shift Start | | | | | | | | | | | | | | | | |
| First Shift End | | | | | | | | | | | | | | | | |
| Second Shift Start | | | | | | | | | | | | | | | | |
| Second Shift End | | | | | | | | | | | | | | | | |
| Third Shift Start | | | | | | | | | | | | | | | | |
| Third Shift End | | | | | | | | | | | | | | | | |

OPERATORS

First Shift: _____

Second Shift: _____

Third Shift: _____

LIQUID LINE ICEMAKER SIGHT GLASS

First Shift:

Second Shift:

Third Shift:

| | | |
|--|--|--|
| | | |
| | | |
| | | |

REMARKS

First Shift: _____

Second Shift: _____

Third Shift: _____

Table 6-3 Weekly Rake Hoist Inspection Sheet

Inspected by: _____

Date: _____

Motor Bolts: _____

Reservoir Oil: _____

Cable Bolts: _____

Cable Wear: _____

Pulley Bearings Lubricated: _____

Pulley Bolts: _____

Table 6-4 Weekly Door Hoist Inspection Sheet

Inspected by: _____

Date: _____

Mounting Bolts (cylinder): _____

Cylinder Shaft _____

Top Pulley Bracket: _____

Door Lifting Eye: _____

Cable Clamp Bolts: _____

Cable Wear: _____

Pulley Bolts: _____

Door Arm Pins (cotter keys): _____

Table 6-5 Weekly Rake Inspection Sheet

Inspected by: _____

Date: _____

Rake Drive Sprocket Teeth: _____

Rake Drive Sprocket Hub Set Screw: _____

Reducer Shaft Hub Bolts: _____

Reducer Oil: _____

Reducer Mounting Bolts: _____

Flite Chain Tension: _____ Alignment: _____

Flite Drive Sprockets: _____ Teeth: _____

Flite Idler Sprockets: _____ Alignment: _____

Flite Idler Sprockets: _____ Teeth: _____

Flite Idler Sprocket Bearings: _____

Flite Attachment Bolts: _____

Flite Wearing Pad Thickness: _____

Flite Wearing Pad Bolts: _____

Drive Shaft Bearing Bolts: _____

Idler Shaft Bearing Bolts: _____

K-1 Attachment Relief Holes in Flites: _____

Rake Bin Door Warning Labels*: _____

Control Panel Warning Labels*: _____

Retaining Wall Warning Labels*: _____

Other Warning Labels*: _____

- Warning labels should be attached, visible and legible. TURBO recommends that warning labels for any additional equipment not supplied by TURBO be added to this sheet.

Table 6-7 General Inspection Sheet

[illegible]

Notes:



CB Series Rake Manual Installation, Operation & Maintenance

OPTIONAL FEATURES & ACCESSORIES

You can maximize your rake system's operating potential by adding optional features and accessories. If you need more details about the options listed below, contact TURBO.

Soft Start – Upgrade (Standard on Current models)

The soft start controller applied to the rake drive motor will provide a smooth start to eliminate mechanical stress on the rake drive and chains.

The soft start function uses two different approaches to achieve this.

Voltage/Time Ramp

Voltage is increased linearly with time until full line voltage is applied to the motor terminals. The torque is adjustable from 10 to 80 percent of motor voltage because torque at lower voltages is negligible. For example, a voltage ramp that begins at zero volts may not begin to move the motor for several seconds.

Current Limit Ramp

Load current is sensed via a current transformer and compared with a preset limit (300 to 550 percent of the full

load current). This is not available on model PM2-A.

Voltage/time ramp is recommended with the current limit ramp to provide a continuous safeguard from over current. A particularly long ramp will override the current limit control during start-up. Once the motor has been started, the energy saving circuit will switch out.

Hydraulic Bin Door - Upgrade

A hydraulic bin door opener can be provided for ease of operation or remote operation of the rake bin door. A hydraulic cylinder is used in place of the 2,000 pound hand-winch. The standard hydraulic power unit used to lift the rake is modified to provide hydraulic power to the bin door cylinder. Two momentary push button operators are used to open and close the door.

Automatic Hydraulic Bin Door (Standard on Current Models) – Upgrades Available for Older Models

In addition to the hydraulic bin door option which provides manual push button operators to open and close the bin door, an automatic door option is available. Similar to the

hydraulic door, the automatic door option uses a hydraulic cylinder and a modified hydraulic power unit (which is used to lift the rake).

A set of limit switches and control relays are provided to automatically open or close the rake bin door in response to the setting of the "Delivery" selector switch. The bin door opens when the selector switch is in the ON position and closes when the selector switch is in the OFF position.

Automatic purging of the floor screw at the termination of the UNLOAD (or delivery OFF switch for newer models) sequence is included.

The automatic door eliminates the need for the operator to remember to open or close the bin door which can result in equipment damage or delays in loading or unloading operations.

Plastic Chain/Drive Sprockets - Option

Standard TURBO rakes are furnished with nickel coated chain, sprockets, and flite attachments. Locking collars are ground and polished shafts (cold galvanized).

Plastic chain, sprockets, and flite attachments with stainless

steel locking collars and shafts are available for applications requiring a higher degree of corrosion protection.

The plastic chain and stainless steel components are directly interchangeable with the standard components and may be installed at any time.

With the plastic chain option, the load detector/soft start controls must also be used.

Programmable Logic Controller (PLC) -

Conversion

Older TURBO rakes are provided with electrical panels to control the operation of the rake hoist and rake drive. Separate mechanical sequence timers are provided for the rake hoist and rake drive in addition to time delay relays and control relays.

Hoist up frequency and duration is controlled by a sequence cam timer and time delay relay with an adjustable knob. Frequency is controlled by selecting a gear rack to match the operating cycle; duration is set on a solid state time delay. If ice production varies, a separate setting must be made for each level of production. A similar scheme is used to control the rake drive forward and reverse operation.

A PLC upgrade is available to control the rake hoist and rake drive sequence as well as all other functions normally controlled by the mechanical relays and timers described

above with a programmable controller.

Each PLC is provided with pre-wired input and output relays, a power supply, and central processing unit (CPU).

Winter/summer time settings can be easily programmed using the PLC hand held programmer provided. Additional CPUs or EEPROM chips are available to provide a quick and easy change out of winter/summer cycles.

Instruction manuals are included with each PLC to provide the customer with the information required to program and use the PLC. A factory supplied program is installed in the PLC. Upon request, additional safety inputs or controls can be added to the standard PLC program at the factory. Consult a TURBO representative for specific applications and programming costs.

PLC's provide a quick, reliable means of making exact changes to timer and control settings without the hassle of trial and error settings on mechanical sequence cam timers.

Using a PLC in conjunction with a load detector/soft start provides the user a controlled system able to handle numerous ice production and delivery rates without the need for complicated or time consuming resetting of controls.

Note:

In ambient temperatures below 40°F, it is recommended that an external source of heat be provided in the control panel to ensure maximum operating performance from the PLC. TURBO provides a thermostatically controlled heat source for models with PLC controls.

Control Panel Winterizing

Ambient temperatures can affect many of the electronic controls in the hydraulic rake control panel. In general, the devices TURBO uses operate properly in temperatures between 32°F and 140°F.

In ambients under 40°F, TURBO recommends that a source of heat be available in the control panel to maintain a temperature above 40°F. This will ensure continuous, reliable operation of all components (even in severe applications*). A winterizing kit consisting of a heat source and control thermostat can be provided as a factory installation or as a retrofit to existing control panels.

- * The control panel winterizing kit is designed for equipment operations in ranges from 0 to 40°F. Consult TURBO for equipment operations in conditions below 0°F.

Custom Bin Size Dimensions

TURBO rakes are available in nine (9) standard sizes to meet

Options and Accessories

a wide variety of needs and applications. In the event that none of the standard sizes can be used to fit existing space or facilities, custom sizes can be produced to meet special requirements.

Width Variations

Variations between 7'-6" and 15'-0" are available with modifications of the standard 10', 12'-6" and 14'-6" wide rakes. CB rakes under 9'-0" require special designs and are not recommended. Automatic series rakes should be considered for widths over 15'-0".

Length Variations

Variations between 15'-0" and 30'-0" are available with modifications to the standard 20' and 25' long rakes. Lengths over 30'-0" require special designs. Automatic series rakes should be considered for lengths over 30'.

Height Variations

Ice height variation between 4'-0" and the standard 12'-4" are available with modifications to the standard 5'-0", 7'-10", 9'-6" and 12'-4" models. Ice heights under 4'-0" require special designs and are not recommended. Ice height modifications over 12'-4" are

not available in the CB series rake. The use of dual CB rakes or Automatic rakes should be considered if the ice height exceeds 12'-4". To determine the overall rake height add 5'-0" to the ice height.

Because of the wide variety of possible combinations, rakes with custom dimensions are quoted on an individual basis. Consult a TURBO representative or salesman for details.

Standard size rakes are recommended to eliminate the need for special components. Special components could require longer lead times for replacements (due to normal wear or damage) and could mean higher replacement costs.

Bin Level Switch

A motor driven bin level switch is mounted on the rake girder to detect when the rake bin is full. The contacts of the bin level switch are used to turn the rake and icemaker off. When the ice is removed, the bin level switch automatically resets.

All standard rakes are provided with a Bin FULL limit switch assembly. An optional Bin

EMPTY limit switch assembly is also available. The bin empty level switch described above is normally used as a status indicator to indicate the ice level in the bin. It is not required for normal operation of the rake. It could be used to automatically turn ON icemakers or ice generators when the bin is empty.

Rake Flite Limit Switch

A limit switch is mounted on the structural cross member next to the rake drive base. As the rake flites rotate during normal operation, the switch is periodically tripped. The contacts of the limit switch are connected to an input of the PLC and the PLC logic has an internal timer that is reset each time the switch is tripped.

If the rake drive fails, or the chain (drive or rake chain), the switch will not trip in the PLC preset time and the rake operation will terminate to prevent damage to the system.

The kit consists of the limit switch, conduit cord and counterweight, instructions, and a PLC program tape. Field installation is required for all components