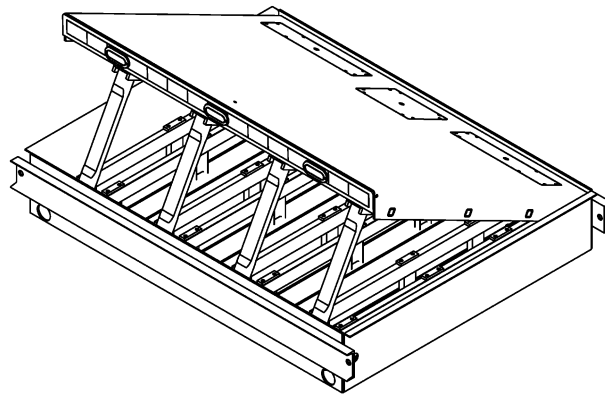

SW1900-H

ASTM M50 P1 ACTIVE WEDGE BARRIER

OWNER/OPERATOR MANUAL

RELEASE – MAY 14, 2013



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HOW TO CONTACT US

Global GRAB Technologies is dedicated to providing products and a service that is of the highest quality. We will do everything we can to quickly resolve any problems that may arise with our barrier.

If you have any questions or experience problems with your SW1900-H barrier, please contact the appropriate department listed below.

PREVENTATIVE MAINTENANCE: (866) 504-4722

SPARE PARTS: (866) 504-4722

EMERGENCY SERVICE & WARRANTY CLAIMS: (866) 504-4722

TECHNICAL ASSISTANCE: (866) 504-4722

TRAINING: (866) 504-4722

CORPORATE HEADQUARTERS: (615) 224-0400

SYSTEM INSTALLATION RECORD

In order to document the components of your system, please use the table below to record the listed reference information. This information can be located on the label located on the inside of the junction box door inside the wedge.

SITE	
SERIAL #	
MODEL #	
DATE OF MFG	



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SW1900-H

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SW1900-H OVERVIEW

The Global GRAB Technologies SW1900-H Active Wedge Barrier is designed to alternately allow or deny vehicle access to a secure facility. The SW1900-H is an anti-ram barrier capable of stopping a 15,000 lb. vehicle travelling 50 mph with zero penetration into the facility.

The barrier consists of a steel vault cast in reinforced concrete, a hinged steel lid, and the associated hardware and controls required for the steel lid to be raised from a position flush with the roadway to an upright secured position. This movement is accomplished automatically through the use of a hydraulic cylinder. The SW1900-H is designed for easy installation requiring a minimal (18") excavation depth, a simple rebar structure, and pre-plumbed connections for drains, power, and controls.





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CRASH TEST CERTIFICATIONS & DURABILITY

US Federal agencies have recognized test standards using full scale crash tests to quantify, verify, and certify barrier performance. The current standard test method for vehicle crash testing of perimeter barriers acknowledged by the U.S. Department of State, Department of Defense, and Department of Energy, is ASTM F2656-07.

The SW1900-H Active Wedge Barrier was tested according to the ASTM parameters for speed of impact, weight of threat vehicle, and penetration of threat vehicle. Tests were carried out by an independent third party test lab, authorized to impartially test and certify vehicle barriers per the ASTM standards.

A 15,000 lbs Medium Truck was driven into the front of the barrier at 50 mph.

The SW1900-H successfully resisted the impact with zero penetration, earning an M50 (P1) rating.

Following the independent 3rd party testing, the test vehicle's wreckage was removed, and the SW1900-H was immediately cycled multiple times under its own power. No replacement hoses or fittings were required, and there were no hydraulic leaks or damage to operating components. Laboratory vehicles were also driven over the barrier following the conclusion of the test, demonstrating that the SW1900-H can withstand an impact and remain functional.

The SW1900-H barrier used in the crash test then completed over 30,000 cycles under its own power and demonstrated an Emergency Fast Operate (EFO) deployment speed of less than 2 seconds.

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SW1900-H FEATURES

The SW1900-H wedge barrier has the following features;

- ASTM M50 P1 certified with ZERO penetration
- Emergency Fast Operate (EFO), which means barrier will deploy in less than 2 seconds
- Hydraulic actuation (Electro-mechanical version identical barrier structure also available).
- Available widths from 8 to 16 feet wide in 1 foot increments.
- 18-inch shallow depth foundation.
- One day installation, ready to install as shipped.
- No disassembly and no concrete finishing required inside barrier during installation.
- Pre-plumbed drain and control pathways designed not to interfere with rebar placement
- Noise dampening technology
- Access panels that allow ease of service without raising the barrier
- 4" diameter gravity drains with a grating cover located in each corner of the wedge, allowing for drainage regardless of road pitch
- OPTIONAL 1100 GPH, self-priming, submersible sump pump to supplement gravity drains.
- DOT approved, retro-reflective red/white tape on front face of barrier
- OPTIONAL LED lights for enhanced visibility.
- OPTIONAL heating system to keep wedge lid clear of snow and ice in extreme weather.
- One color, 10 – 12 mil thick acrylic urethane paint with epoxy primer and anti-skid aggregate on lid. The same paint system is used on the vault only with 5-8 mil paint thickness.
- OPTIONAL two-color painted lid with striped pattern.
- OPTIONAL galvanized vault for improved long term corrosion resistance.

The SW1900 Hydraulic Power Unit has the following features;

- 5 HP, 3 GPM pump with nitrogen filled accumulator
- Custom hydraulic manifold with solenoid operated control valves and manual override feature
- Gages that include an analog style pressure gage, fluid level gage, and fluid temperature gage.
- Spin on hydraulic fluid filter and analog style filter restriction gage.
- OPTIONAL electronic filter restriction monitor and alarm
- Manual hand pump capable of raising wedge barrier in the event of power failure
- NEMA 3R rated enclosures
- OPTIONAL stainless steel NEMA 4X rated enclosure

The SW1900 Control System has the following features;

- PLC control with flexible programming, inputs and outputs to suit client needs.
- Power Supply Flexibility (208VAC – 240 VAC 3-Phase)
- 8"x8" NEMA 12 Operator Panel with Up/Down/EFO/EFO Reset pushbuttons for two wedges.
- OPTIONAL emergency stop to instantly stop wedge regardless of position, direction, or speed.
- OPTIONAL fault indicator light and annunciator to indicate fault condition or wedge movement.
- OPTIONAL customized controls available including integration of multiple traffic control devices.
- Service controls at wedge to enable localized control for maintenance and service.
- 2-channel loop detector module and accessory outlet.
- OPTIONAL battery backup for controls.

- OPTIONAL surge suppression to protect electrical components.
- OPTIONAL electrical disconnect and sequence of events recorder.

SW1900-H SAFETY

GENERAL SAFETY

This manual should be read and understood by the person operating the equipment. Extra copies are available from the manufacturer. The operator must understand all warnings, control systems, and labels included with the barrier before operating this product. Failure to do so can result in serious injury.

General Safety Rules include;

- Do not modify the equipment in any way. Modifications can result in serious injury and voids the equipment warranty.
- **NEVER** defeat a safety guard or device for any reason.
- **NEVER** operate equipment with the access panels removed unless performing maintenance.
- Keep walking and driving surfaces around the barrier clean and uncluttered.
- **NEVER** operate the equipment if you are under the influence of drugs, alcohol or medications that may make you less alert or affect your judgment.
- Personnel who are not required to be in the area of the wedge should be kept away. **NEVER** operate the equipment unless you are absolutely certain that all personnel are clear of the barrier.
- **ANNUNCIATOR (if installed)**: The horn can be adjusted to operate between 78 dB-103 dB. Prolonged exposure to this level may require the use of ear protection.
- **NEVER** stand on or near the attack plate. When the barrier is up, it could lower quickly and trap you. When the barrier is down, it could raise under you causing a fall.
- There may be trip hazards such as raised curbs or signal poles near the SW1900-H barrier system. Watch your step.

GENERAL MAINTENANCE SAFETY

This manual should be read and understood by the person performing maintenance on the equipment.

General Maintenance Safety Rules include;

- Only qualified electricians or authorized technicians should be allowed to work on electrical components.
- When servicing equipment, always wear proper apparel. Loose clothing can get caught in moving parts. Always wear reflective clothing/vest.
- **NEVER** remove any access panels while power is ON at the control panel.
- Ensure that **ELECTRICAL AND HYDRAULIC SHUTDOWN PROCEDURES** located in this manual are completed before any maintenance or service work is performed. If provided, ensure battery backup is also disconnected.
- **NEVER** clean, lubricate or adjust the equipment while any parts are moving, while the equipment power is ON, or while hydraulic pressure is present.
- Ensure that traffic safety cones are properly utilized to effectively stop or detour traffic around the barrier while maintenance is being performed
- Following maintenance work, ensure all access panels and safety devices are installed and are in



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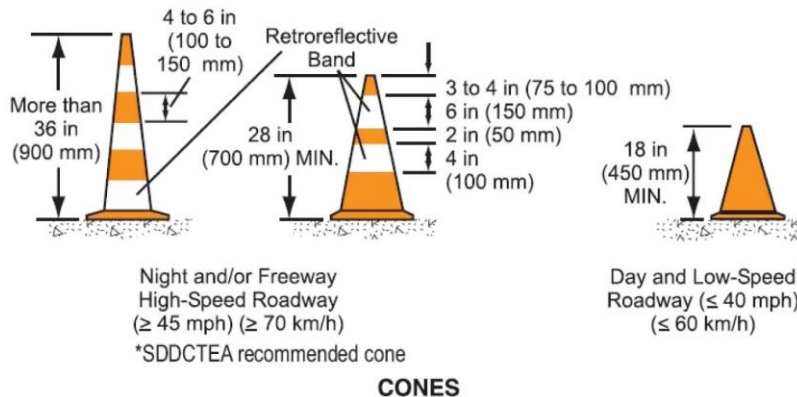
proper working order.

SW1900-H SAFETY (CONTINUED)

TRAFFIC SAFETY

In the event of operating the barrier outside normal sequence of operation or performing service on the barrier, contact the owner/property manager to verify proper procedure for controlling or rerouting traffic at the barrier. The property owner or manager must have full knowledge of traffic plans to reroute traffic, or of plans for a complete roadway shutdown.

Ensure that safety cones are properly utilized to effectively stop or detour traffic around the barrier while maintenance is being performed. Ensure that the properly sized cones are utilized given the site conditions and time of day/night.



SAFETY LABELS

Safety labels are located on the barrier to alert the operator to possible hazards. Please ensure the safety labels are understood and the instructions on them are followed before operating the barrier. If the labels become illegible, damaged, or fall off the equipment, call S&W for replacements. Do not deface the labels or remove them from the equipment.



Safety Labels can be found in your wedge barrier in the following locations;

- **HIGH VOLTAGE** labels are located on each Wedge Junction Box and on the exterior of the Barrier Control Panel (BCP) door



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- **DANGER MOVING PARTS** labels are located on the side of the wedge lid.

SW1900-H SAFETY (CONTINUED)

ELECTRICAL SAFETY

Only qualified electricians or authorized technicians should be allowed to work on electrical components. Qualified personnel should know the location of all electrical junction boxes, disconnects, and similar devices. If an electrical system failure is suspected, shut off power to the equipment and call S&W for guidance. If your SW1900-H is equipped with a UPS/Battery Backup System, it must be de-energized as well; otherwise your system could still have power.

OSHA REQUIREMENTS

OSHA Regulation 1910.147(c)(1) states that the employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that before any employee performs any service or maintenance on a machine or equipment where the unexpected energizing, startup, or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source and rendered inoperative. Qualified personnel must follow the lockout/tagout procedures established by the Employer as required by OSHA.

NFPA GUIDELINES

The following minimum NFPA steps must be taken to ensure an electrically safe work condition:

1. Determine all sources of energy by reviewing up-to-date drawings.
2. Disconnect all sources of energy by operating adequately rated disconnecting means.
3. Inspect, whenever possible, energy-isolating devices for visible breaks in the power conductors.
4. Perform a voltage test to determine the absence of voltage.
5. Install grounding devices, if determined necessary.
6. Install locks and tags per facility lockout / tagout procedures.



CAUTION: Only properly trained personnel should manipulate the electrical disconnect. Failure to properly secure power to the SW1900-H control system may result in serious injury from electrical shock.

SW1900-H ELECTRICAL SHUTDOWN

The Barrier Control Panel (BCP) has high voltage inside. Never work inside the Barrier Control Panel with the power on. The following steps outline how to shutdown electrical power:

SW1900-H WITHOUT BATTERY BACKUP

If the control panel is equipped with an optional main breaker disconnect switch, turn the switch in a counter clockwise direction to the green 'OFF' position. The switch is located on the front door of the control cabinet. See Figure 1. If the control panel is not equipped with a main breaker disconnect switch, turn the main breaker located inside the panel to the "OFF" position. See Figure 2.

SW1900-H SAFETY (CONTINUED)



Figure 1 – Main Disconnect



Figure 2 - Main Breaker

Verify with a meter that voltage is no longer present at the load side of the main disconnect. **Be aware that high voltage is still present where the incoming power is terminated at the terminal blocks and to the line side of the main disconnect. To further ensure that no high voltage is present in the panel, you should additionally turn the panel board breaker off that is supplying the 208/240VAC power to the BCP.** Follow any lockout/tagout procedures as designated by your facility before proceeding.

SW1900-H WITH BATTERY BACKUP

Based on the customer order, the 24VDC barrier controls may be equipped with Battery Back Up (or UPS). See Figure 3. **This power source must be de-energized before performing any maintenance on the barrier or working inside the BCP enclosure.** Follow the instructions in the Section “SW1900-H Without Battery Backup” to remove power from the Main Disconnect or Breaker. Once main power is removed and verified with a meter, turn off all breakers in the BCP enclosure by moving them to the OFF position. Finally:

1. Remove the fuse installed in the circuit between the UPS and the battery.
2. Using a meter, confirm that voltage is no longer present at the “+” and “-” Output terminals of the DC UPS.



CAUTION: If battery backup or a UPS is installed, ensure that it is shutdown and the battery is disconnected prior to working on the SW1900H or in the BCP enclosure.



Figure 3 – 24VDC Battery Backup (UPS)

SW1900-H SAFETY (CONTINUED)

NEVER disconnect the grounding wire from the SW1900-H Barrier Control Panel. See Figure 4.



Figure 4 – BCP Ground Wire

SW1900-H HYDRAULIC SHUTDOWN

Prior to doing maintenance on any portion of the system, the hydraulic system must be shut down and all hydraulic pressure must be bled from the system. To shutdown the hydraulic system, follow the steps below:

1. Turn off the pump motor starter/protector inside the Barrier Control Panel (BCP). The switch will rotate counter-clockwise until the handle is horizontal. See Figures 5 & 6.



Figure 5 – Motor Starter

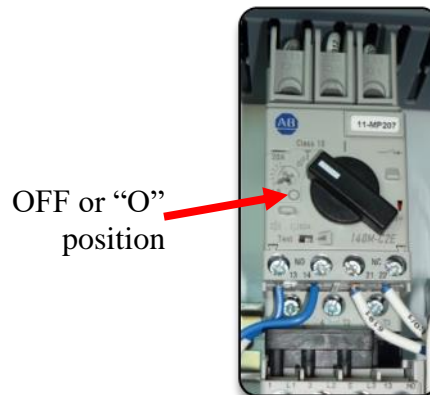


Figure 6 – Rotate Switch Counter-Clockwise to "O"

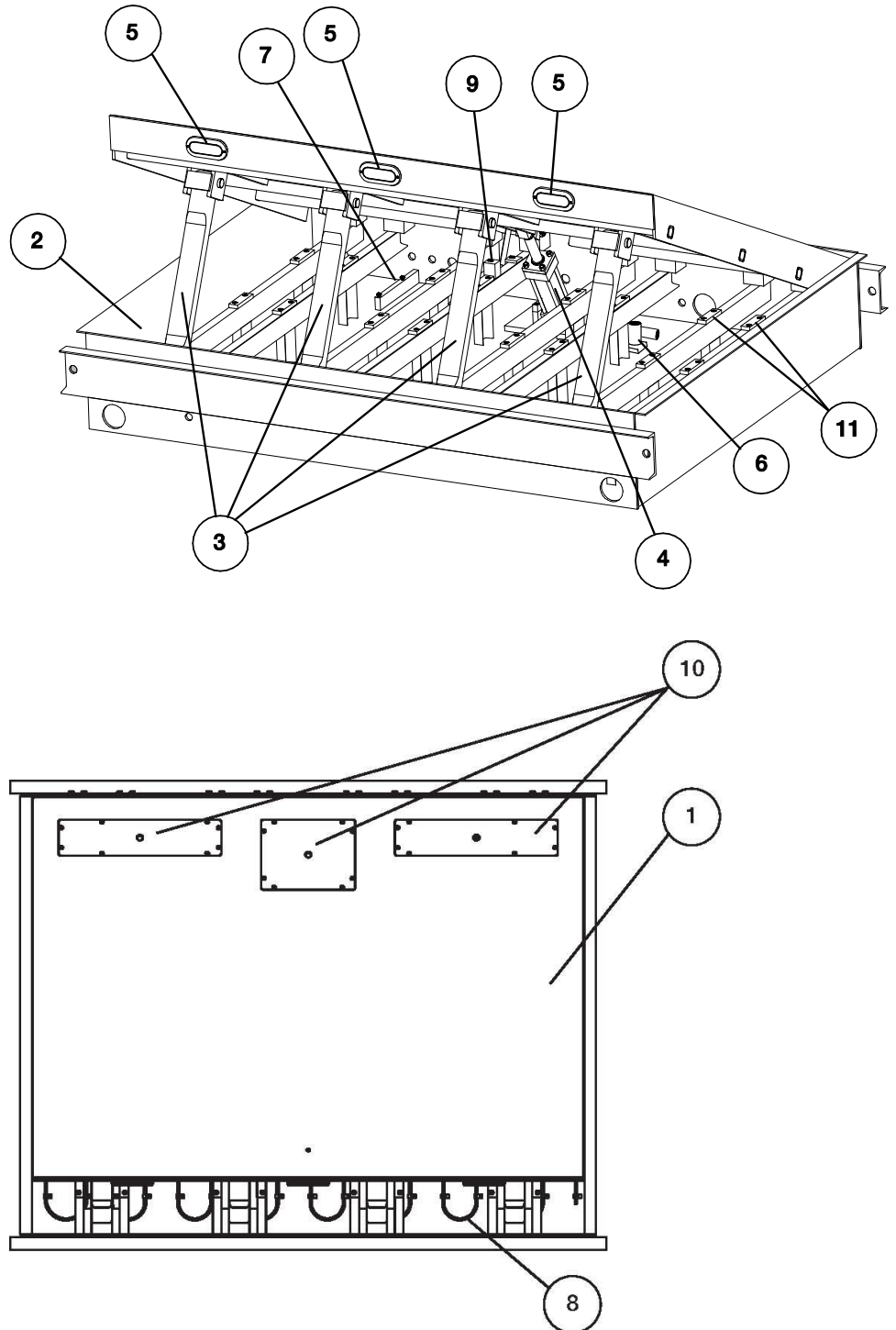
2. Dump the hydraulic pressure by lifting the manual dump valve (red handle) on the valve manifold and hold it in the up position until the hydraulic pressure gauge reads zero. This will release all the hydraulic pressure in the system. Ensure the gauge reads zero before performing any work on the barrier hydraulic system. See Figure 7.

Manual
Dump Valve



Figure 7 – Hydraulic Manifold

SW1900-H OVERVIEW





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SW1900-H OVERVIEW

1. Attack Plate
2. Vault
3. Straps
4. Cylinder
5. Warning Light (optional)
6. Sump Pump (optional)
7. Mounting for Junction
Box
8. Heater (optional)
9. Limit Switches
10. Service Access Panels
11. Bearing Blocks (multiple)

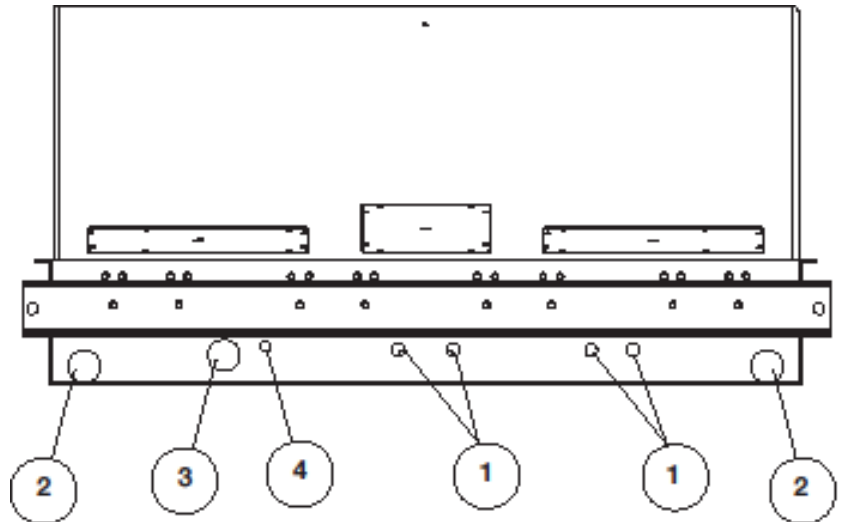
SW1900-H BACK & FRONT PLANE

1. Cut-out for 1.25" Electrical Conduit
2. Cut-out for 4" PVC Schedule 40 Drain Coupling (hub supplied)
3. Cut-out for 4" PVC Hydraulic Hose Pathway
4. Cut-out for 1" Sump Pump Discharge (hub supplied)
5. Cut-out for 1" Sump Pump Discharge (alt. location)

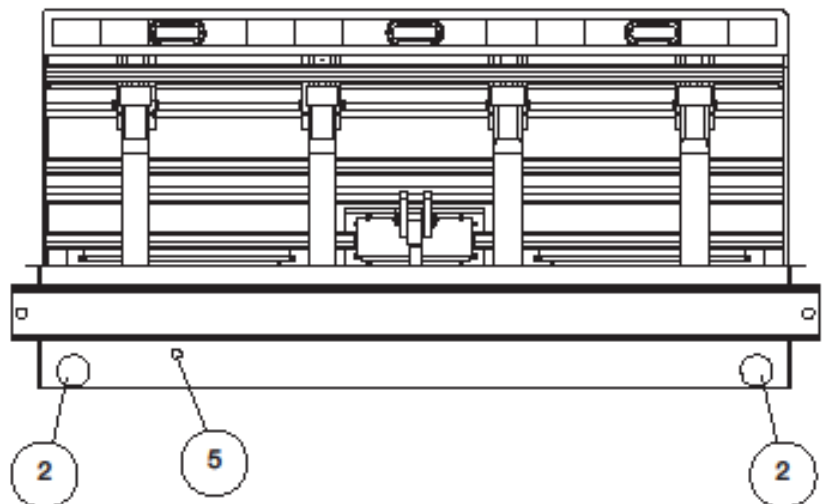
The SW1900-H has a number of conveniently located pathways for installing control & power conduit, hydraulic lines, drains, and sump pump discharge.

These are cut out of the back and front planes of the Vault (see details below), and are fitted with the appropriate connections/hubs.

BACK



FRONT



SW1900-H DESCRIPTION OF PARTS

ATTACK PLATE

The Attack Plate (raising lid of barrier) is a reinforced heavy gauge steel plate that pivots to a predetermined angle when barrier is activated. This plate receives the initial force of an impact. See Figure 8.

The Attack Plate is connected to a bearing plate at the rear of the barrier by custom designed hinges. The front underside of the Attack Plate is connected to the Straps by a welded steel bracket.



Figure 8 – Attack Plate



Figure 9 – Straps

STRAPS & STRAP ANCHORS

The Straps are made from a high-strength, synthetic material. See Figure 9. They unfold as the Attack Plate is raised and are stretched taut when wedge barrier is in fully raised position, preventing the Attack Plate from pivoting further in the event of an impact.

The textile straps allow for near silent operation and are durable over thousands of cycles.

The tops of the straps are attached to the underside of the Attack Plate via welded, heavy gauge steel anchors. The bottoms of the straps are anchored to the structural channels inside the Vault via a steel pin.

VAULT

The Vault forms the structural frame of the SW1900-H. It is constructed from heavy gauge steel and structural steel channels and bracing. See Figure 10.

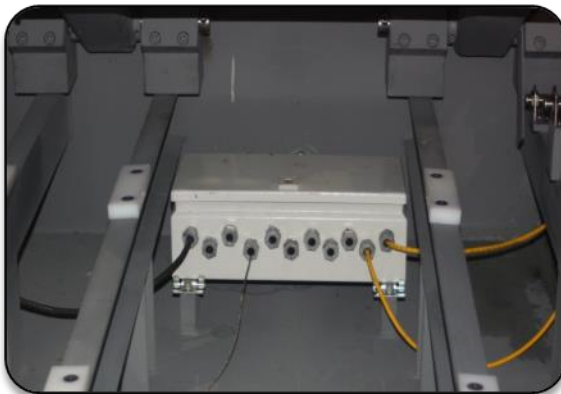
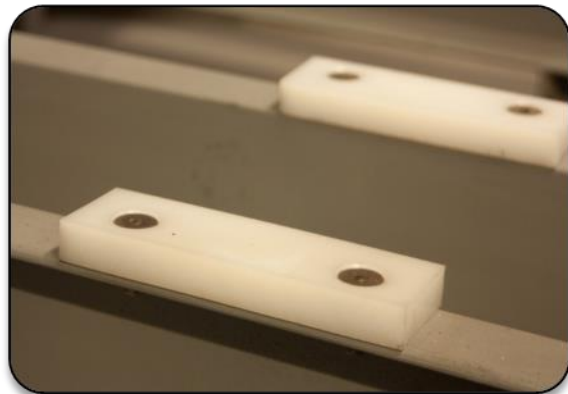
The Vault houses many of the SW1900-H's components, such as: the Hydraulic Cylinder, Drains, Heater, Sump Pump, and Limit Switches.

HYDRAULIC CYLINDER

The Hydraulic Cylinder provides the driving force to raise the Attack Plate. See Figure 11.

SW1900-H DESCRIPTION OF PARTS (CONTINUED)*Figure 10 – Vault**Figure 11 – Cylinder***JUNCTION BOX**

The Junction Box is mounted onto welded tabs next to the Actuator/Piston, between two steel channels. See Figure 12. It provides a centralized, easily accessible hub to route the power and controls conduit and wire.

*Figure 12 – Junction Box**Figure 13 – Bearing Blocks***BEARING BLOCKS**

The Bearing Blocks provide support for the Attack Plate when in the down position. See Figure 13. They also aid in the quiet operation of the SW1900-H by providing dampening between the two steel surfaces.

SW1900-H DESCRIPTION OF PARTS (CONTINUED)

SERVICE ACCESS PANELS

There are at least three removable access panels located on the rear top side of the Attack Plate. These are held in place by screws and can be removed to access components for preventative maintenance and repair. See Figures 14 & 15.



CAUTION: Extreme caution should be used when working on the SW1900-H with the access panels removed. There are moving components and high voltages present.

When working on the SW1900-H, caution should be exercised as the hydraulic cylinder and hoses are under extreme pressure.



Figure 14 – Removing an Access Panel



Figure 15 – (3) Removable Access Panels

SUMP PUMP

This optional pump assists the gravity drains in expelling water from the Vault. See Figure 16.



Figure 16 – Sump Pump



Figure 17 – Drain (Exterior)



Figure 18 – Drain (Interior)

DRAINS

There are (4) four 4.5" diameter drain cutouts, (2) two on the front of the vault and (2) two on the rear of the vault (see Back & Front Plane). These can be connected to 4" PVC Schedule 40 coupling and 4" pipe to facilitate drainage to an existing system or an appropriate discharge. See Figures 17 & 18.

SW1900-H DESCRIPTION OF PARTS (CONTINUED)

HYDRAULIC HOSE PATHWAY

There is (1) one 4.5" diameter cut-out at the rear of the Vault. See Figure 19. This can be connected to 4" PVC pipe to provide a pathway for the hydraulic hoses.

Note: For wider barriers that require two Hydraulic Cylinders, (2) two hose cut-outs are provided.



Figure 19 – Hydraulic Hose Pathway

BARRIER HEATERS

The wedge structure may have optional heaters to remove snow and ice build-up on the exterior of the barrier. The heat system consists of heat mats mounted to the bottom side of the plate and a heat trace cable attached to the vault floor. See Figures 20 & 21.



CAUTION: These heaters are operated at high voltage and can be hot to the touch. The attack plate of the wedge may also be hot to the touch. Please use caution.



Figure 20 – Heat Mats

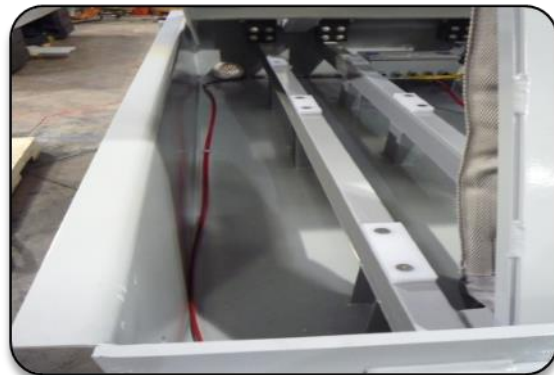


Figure 21 – Heat Trace Cable

ELECTRICAL & CONTROLS OVERVIEW



BARRIER CONTROL PANEL (BCP)

The BCP incoming power supplied by the customer shall be 208VAC or 240VAC, three-phase, 4-wire plus ground. See Figure 22. This is the only power required for a standard product and runs the HPU and associated equipment. Please refer to the drawing package for termination locations and more information. Incoming voltage should be wired as indicated and meet all NEC, state, and local codes as required.



Figure 22 – Barrier Control Panel



Figure 23 – 24VDC Power Supply & Optional BBU

NORMAL OPERATION

The main control circuit is 24VDC. Take special care if your system includes the optional battery backup unit. See Figure 23. The battery must be disconnected to insure power shutdown. The controls are designed to operate up to (2) independently operated SW1900-H wedges. Custom controls can be provided for a variety of accessories.

EMERGENCY FAST OPERATION (EFO)

All barriers come standard with an Emergency Fast Operate. This function closes the barrier in less than 2.0 seconds.



CAUTION: Once an EFO is activated, it cannot be deactivated. The barrier will continue to the closed position.

OPERATOR CONTROLS



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All SW1900-H barriers come standard with two methods of operator controls: Service Controls which are mounted on the door of the Barrier Control Panel and a Standard Operator Panel (SOP) which can be hardwired to a remote location. All SW1900-H barrier controls can be custom modified for each wedge.

ELECTRICAL & CONTROLS OVERVIEW (CONTINUED)

Other operator controls may include: a Master Control Panel (MCP), a Local Control Panel (LCP), a Guard Booth Panel (GB), an Overwatch Panel (OW) or any combination thereof. **Please refer to the drawings and sequence of operations provided in the site specific drawing package for provided equipment and proper operation.**

SERVICE CONTROLS

All barriers come standard with the ability to operate the barriers using the Service Controls mounted on the front of the BCP. See Figure 24. Basic functionality is as follows:

- “B1/OFF/B2” Keyswitch
 - This is a 3-position, maintained keyswitch normally in the “OFF” position yielding control of the barrier(s) to the Standard Operator Panel. It is keyed to match the “Power On” keyswitch on the Standard Operator Panel.
 - To grant control of the barrier(s) to the Service Controls, the Standard Operator Panel “Power On” keyswitch must be turned to the “OFF” position. Remove the key and insert it into the Service Controls “B1/OFF/B2” keyswitch.
 - Turn this keyswitch to the “B1” position to control the motion of Barrier 1. The “Barrier Close/Open” selector switch will now be operable for this barrier only. Refer to your drawing package to determine which barrier is designated as B1.
 - Turn this keyswitch to the “B2” position to control the motion of Barrier 2 (if present.) The “Barrier Close/Open” selector switch will now be operable for this barrier only. Refer to your drawing package to determine which barrier is designated as B2.
 - The key can only be removed from the “OFF” position.
- “Barrier Close/Open” Selector Switch
 - This is a 3-position, spring-return to center selector switch. Normal position of this selector switch is the center position.
 - If the “B1/OFF/B2” keyswitch is in the “OFF” position, this selector switch will not function regardless of which position it is in.
 - With the “B1/OFF/B2” keyswitch in the “B1” position, turn the “Barrier Close/Open” switch to the “Close” position to Close the roadway and raise Barrier 1. Turn to the “Open” position to Open the roadway and lower Barrier 1.
 - With the “B1/OFF/B2” keyswitch in the “B2” position, turn the “Barrier Close/Open” switch to the “Close” position to Close the roadway and raise Barrier 2. Turn to the “Open” position to Open the roadway and lower Barrier 2.

STANDARD OPERATOR PANEL

All barriers come standard with a slope-front, NEMA 12 Standard Operator Panel (SOP) which allows operation of the barriers from a distance. See Figure 25. Basic functionality is as follows:

- “Power On” keyswitch
 - This is a 2-position, maintained keyswitch and is keyed to match the “B1/OFF/B2” keyswitch on the Service Controls. Normal position of this selector switch is the “ON” position granting control of the barrier(s) to the SOP.



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- Turn this keyswitch to the “OFF” position to turn off operator control at the Standard Operator Panel and to operate the barrier(s) from the Service Controls.

ELECTRICAL & CONTROLS OVERVIEW (CONTINUED)

- Red “Barrier 1 Close” and “Barrier 2 Close” Pushbuttons
 - Press these pushbuttons to Close the roadway and raise the respective barriers in a non-emergency situation. These pushbuttons are only operable if the “Power On” keyswitch is in the “ON” position.
- Green “Barrier 1 Open” and “Barrier 2 Open” Pushbuttons
 - Press these pushbuttons to Open the roadway and lower the respective barriers in a non-emergency situation. These pushbuttons are only operable if the “Power On” keyswitch is in the “ON” position.
- “EFO Reset” Keyswitch
 - This is a 2-position, spring-return to left keyswitch.
 - Turn this keyswitch momentarily clockwise to reset the system after an EFO has been activated. This will clear the EFO condition and allow normal operation of the barriers to resume. This keyswitch is only operable if the “Power On” keyswitch is in the “ON” position.
- Red Illuminated “EFO” (Emergency Fast Operate) Pushbutton
 - This pushbutton is used to raise the barrier(s) in an emergency situation. It is only operable if the “Power On” keyswitch is in the “ON” position. When pressed, the barrier(s) will deploy as long as the vehicle safety loops are clear. **It is important to note that if your system consists of two barriers, BOTH barriers will deploy at the same time. Additionally, some systems may be configured to raise during EFO regardless of vehicle safety loop status. You should consult your site specific sequence of operations to confirm this function before operating the barrier(s).**
 - If the EFO pushbutton is flashing red, the EFO has been pressed. You will not be able to return to normal operating conditions until the “EFO Reset” keyswitch has been turned as indicated above. The EFO light will turn off at that time.



Figure 24 – Service Controls



Figure 25 – Standard Operator Panel

HYDRAULIC OPERATION

HYDRAULIC POWER UNIT (HPU)

The SW1900-H is powered by a hydraulic power unit (HPU). See Figure 27. The HPU is a system of components that build, store, monitor, and discharge hydraulic pressure on command to the wedge barrier in order to raise the Attack Plate.

The HPU is normally housed in a weatherproof enclosure in close proximity to the wedge barrier. Flexible hoses are used to connect to hydraulic cylinders inside the barrier. The operation of the HPU involves an electric motor spinning a hydraulic gear pump. The pump creates hydraulic pressure that compresses nitrogen gas inside an accumulator. The motor continues to run until the hydraulic pressure reaches a factory set upper limit controlled by a pressure switch.

When the barrier is activated the hydraulic pressure is released from the accumulator, and fluid is directed to the barrier through a valve manifold. Each activation of the barrier will reduce the amount of stored pressure in the accumulators. When the pressure reaches a preset lower limit controlled by the pressure switch, the motor will start again and the hydraulic pressure in the accumulator will rise until the system reaches the upper limit. Please note that the motor may or may not start when the barrier is activated. The operation of the motor is governed solely by the hydraulic pressure switch which will turn the motor on and turn the motor off based on preset pressure limits.

Table 1: Abbreviations

G	PRESSURE SWITCH & GAUGE PORT
ACC	ACCUMULATORS PORT
P	GEAR PUMP PORT
HP1	HAND PUMP
RV1	RELIEF VALVE
SVCV1	WEDGE 1 EXTEND VALVE
NV1	WEDGE 1 FLOW CONTROL VALVE
SVCV2	WEDGE 1 EFO VALVE
NV2	WEDGE 1 EFO FLOW CONTROL VALVE
SVCV3	WEDGE 2 EXTEND VALVE
NV4	WEDGE 2 FLOW CONTROL VALVE
SVCV4	WEDGE 2 EFO VALVE
NV5	WEDGE 2 EFO FLOW CONTROL VALVE
SV1	WEDGE 1 RETRACT VALVE
NV3	WEDGE 1 RETRACT FLOW CONTROL VALVE
SV2	WEDGE 2 RETRACT VALVE
NV6	WEDGE 2 RETRACT FLOW CONTROL VALVE
MP1	SYSTEM PRESSURE DUMP VALVE

SIMPLE HYDRAULIC SCHEMATIC

The hydraulic circuit for the HPU is shown in Figure 26. The centerpiece of the circuit is the valve manifold which couples the pump, a hand pump, the accumulators, the pressure switch, and the control valves. These components are coupled through a header rail inside the manifold and there are 4 parallel flow paths that direct fluid from this header out to the cylinder in the barrier. Table 1 shows the nomenclature used in the schematic.

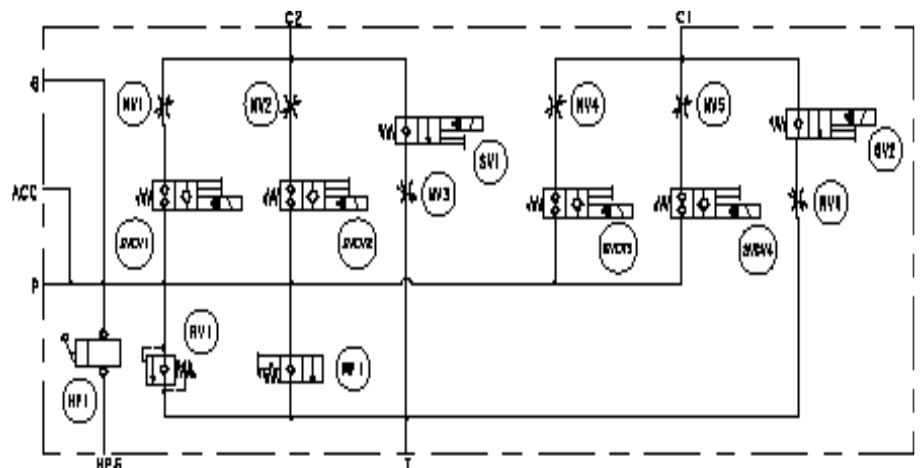


Figure 26 – Hydraulic Circuit

T	TANK RETURN PORT
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HYDRAULIC OPERATION (CONTINUED)

The HPU consists of the following major components:

- Hydraulic reservoir
- Pump/motor assembly
- Hydraulic accumulators
- Hydraulic valve manifold
- Hydraulic oil filter
- Hydraulic pressure switch
- Low level/temperature switch
- Hydraulic reservoir heater (optional)
- Filter Restriction Gauge



Figure 27 – HPU



Figure 28 – Motor Pump Assembly

HYDRAULIC RESERVOIR

The hydraulic reservoir is a steel frame that all the HPU components are mounted on. It also includes the hydraulic oil storage tank, a filler/breather port, a fluid level sight glass, and a spill containment tray.

MOTOR/PUMP ASSEMBLY

The motor/pump assembly consists of an electric motor directly coupled to a hydraulic gear pump. See Figure 28. The motor is a 3-phase TEFC motor rated for 3 hp or 5 hp based on the installation requirements. The gear pump is a 3,000 psi positive displacement hydraulic pump. As stated earlier the pump is directly coupled to the motor face without a flexible drive coupling.

ACCUMULATORS

The accumulators store the hydraulic pressure needed to raise the barrier. See Figure 29. Each accumulator has nitrogen gas pre-charge pressure. The nitrogen gas is above the piston as the



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accumulators are mounted on the HPU. When the motor starts and the gear pump builds pressure, the fluid entering the accumulator and the nitrogen above the piston is compressed. When the barrier is

HYDRAULIC OPERATION (CONTINUED)

activated, the compressed gas pushes the piston down and the oil flows back out of the accumulator and to the barrier.



Figure 29 – Accumulator



Figure 30 – Hydraulic Valve Manifold

HYDRAULIC VALVE MANIFOLD

The hydraulic valve manifold controls the fluid stored in the accumulators and directs it to the barriers when required. See Figures 30 & 31. The manifold includes 6 solenoid controlled cartridge valves and 6 cartridge style flow control valves. These valves can be operated electronically by energizing the solenoid coil or by manually using override knobs on top of the valve stem. To operate a solenoid valve manually, press the red knob on top of the valve stem and turn the knob counter-clockwise. The knob will pop up and the valve is open. To reset the valve, press the knob back down and turn it clockwise to lock it in place.

Four of these solenoid valves control 4 parallel flow paths that direct oil supply to the barriers. The remaining 2 solenoid valves release fluid from these flow paths back to the tank. When a command is issued to raise a barrier at normal speed, a single flow path is opened through the manifold and the barrier rises. When a command is issued to raise a barrier at EFO speed, a 2nd flow path is opened and the barrier rises faster. Each flow path has a flow control valve that is used to increase or decrease the speed the barrier comes up. When a command is issued to lower the barrier the oil is released through a flow control valve and allowed to return to the tank.

The valve manifold also includes a pressure relief valve to protect HPU components from damage and a manual hand pump. The hand pump can be used to manually raise the barrier for maintenance purposes or in the event power loss. The pump can also be used to rebuild pressure in the accumulators if required.

HYDRAULIC OPERATION (CONTINUED)

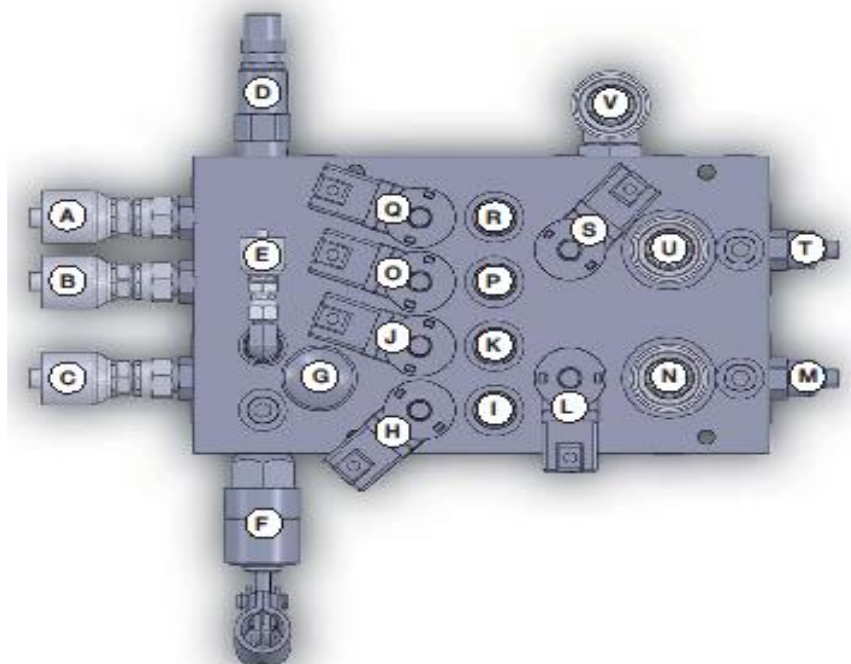


Figure 31 – Hydraulic Valve Manifold

- A- ACCUMULATOR PRESSURE
- B- PUMP PRESSURE
- C- HAND PUMP SUCTION
- D- PRESSURE RELIEF VALVE
- E- PRESSURE SWITCH CONNECTION PORT
- F- HAND PUMP
- G- MANUAL DUMP VALVE
- H- BARRIER 1 EXTEND VALVE
- I- BARRIER 1 EXTEND FLOW CONTROL VALVE
- J- BARRIER 1 EFO VALVE
- K- BARRIER 1 EFO FLOW CONTROL VALVE
- L- BARRIER 1 RETRACT VALVE
- M- BARRIER 1 RETRACT FLOW CONTROL VALVE
- N- BARRIER 1 OIL FLUID CONNECTION PORT
- O- BARRIER 2 EXTEND VALVE
- P- BARRIER 2 EXTEND FLOW CONTROL VALVE
- Q- BARRIER 2 EFO VALVE
- R- BARRIER 2 EFO FLOW CONTROL VALVE
- S- BARRIER 2 RETRACT VALVE
- T- BARRIER 2 RETRACT FLOW CONTROL VALVE

- U- BARRIER OIL FLUID CONNECTION PORT
- V- TANK RETURN CONNECTION PORT

HYDRAULIC OPERATION (CONTINUED)

HYDRAULIC PRESSURE SWITCH

The hydraulic pressure switch is a dual set switch that turns the pump motor on when the pressure falls below a preset lower limit, and turns the motor off when the preset upper pressure limit is reached. See Figure 32. The pressure set points have been preset by Smith & Wesson and adjustment should not be necessary. If adjustment is required, the dual set points allow for the upper and lower pressure limits to be adjusted independently. These set screws can be used to fine tune the pressure settings.



Figure 32 – Pressure Switch



Figure 33 – Low Level/High Temp



Figure 34 – Hydraulic Heater

LOW LEVEL/HIGH TEMPERATURE SWITCH

The low level/high temperature switch monitors the tank fluid level and the tank fluid temperature. See Figure 33. The switch stops the motor should the tank fluid level fall below a preset depth. In the same way, the switch will stop the motor should the tank fluid temperature rise above a preset limit.

HYDRAULIC RESERVOIR HEATER

A hydraulic reservoir heater is available as an option to regulate the temperature of the oil in the tank. See Figure 34. In very cold climates the oil will thicken as the ambient temperature falls. The reservoir heater is a self-regulated resistance heater that is threaded into the tank with a SAE o-ring seal. The junction box cover can be removed to uncover an adjustable thermostat that can be set to the desired temperature. The thermostat set point has been pre-set by Smith & Wesson and adjustment should not be necessary.

MAINTENANCE INTRODUCTION

Regular inspection and consistent operation of the SW1900-H is essential for maintaining the condition and performance of the barrier. Failure to do so may result in decreased performance, increased wear on components, and dangerous conditions.

Throughout the maintenance cycles, the following warnings and procedures **MUST** be followed at every stage. Failure to do so *can* cause serious injury or property damage.



Figure 35, 36, & 37 – Removing the Access Panels

MAINTENANCE INTRODUCTION (CONTINUED)

INSTALLING THE SAFETY BRACES

At various points during the maintenance cycles, it is necessary to install the supplied safety braces. Failure to do so **can** cause serious injury or property damage.

Safety Brace Installation Steps 1-5



(2) SUPPLIED BRACES
MUST BE SLOTTED
INTO PLACE PER
THE FOLLOWING
ILLUSTRATIONS

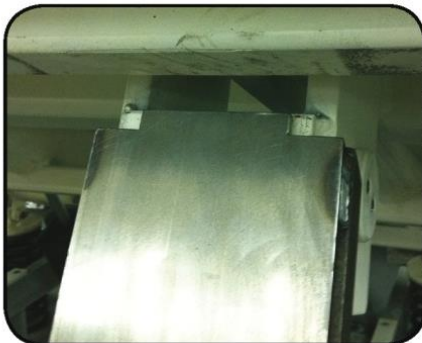
NOTE: BOTH ENDS
OF SUPPORT BRACE
ARE NOTCHED AND
CAN BE INSERTED
EITHER WAY UP



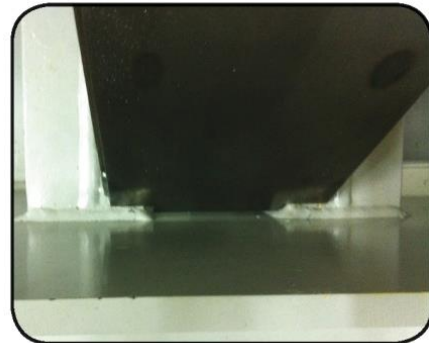
STEP 1:
HOLDING BRACE
BY HANDLE, INSERT
NOTCHED BASE
INTO GAP BETWEEN
STRUCTURAL
MEMBERS.



STEP 2:
CAREFULLY TILT
BRACE BACK TO REST
AGAINST UPPER
STRAP ANCHOR.
BRACE'S UNDERSIDE
SHOULD STRADDLE
STRAP ANCHOR



STEP 3:
MOVE BRACE SIDE
TO SIDE TO ENSURE
TOP OF BRACE IS
FIRMLY STRADDLING
STRAP ANCHOR



STEP 4:
FIRMLY PULL BOTTOM
END OF BRACE
TOWARDS YOU TO
ENSURE THAT IT REST
AGAINST FRONT WALL
OF VAULT

STEP 5:
LOWER ATTACK PLATE ONTO SUPPORT BRACES



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WEEKLY CLEANING & OPERATIONAL CHECK

1. Coordinate with the installation or facility representative to close traffic in the lane in which the SW1900-H is located and in adjacent lanes as required. Ensure appropriate cones are placed in the roadway per local requirements.
2. Visually inspect the SW1900-H for any loose or missing hardware. Replace any missing hardware.
3. After ensuring the area is clear, cycle the SW1900-H and visually inspect all components during operation for any problems (i.e. hydraulic hoses surging or chafing, binding, unusual noises, or other indications of binding components, visible leaks)
4. Cycle the SW1900-H and visually inspect the HPU during operation for any problems (i.e. hydraulic hoses surging or chafing, any signs of hydraulic leaks, pump and pressure switch operation, proper valve operation).
5. Record all observations and contact Smith & Wesson Security Solutions to coordinate any required unscheduled service, replacement parts, or with any questions regarding the performance of the SW1900-H wedge barrier.
6. Place SW1900-H in the full up position.
7. **Install safety support brace in accordance with Safety Brace Installation found in the Maintenance Introduction.**
8. Remove and secure electrical power at the disconnect within the HPU (see Safety - SW1900-H Shut Down). Drain hydraulic pressure completely from the accumulators and hydraulic hoses by triggering the manual dump valve. Comply with applicable lock-out tag-out procedures to ensure that power is not inadvertently restored or that the SW1900-H is not activated from any operator station.
9. Clean and remove any debris from the HPU Enclosure and the surrounding area.
10. Clean and remove any debris from the Vault area, including the drain screens.
11. Inspect Vault area to verify that all components, hardware, hoses, and wiring is properly secured. Verify that the area is clear of all tools, cleaning materials, and any other debris.
12. Before removing lock-out tag-out devices, make sure all personnel are clear of the wedge area.
13. Remove lock-out tag-out devices in accordance with applicable regulations.
14. Restore electrical power at the disconnect and battery backup (if provided), verify the pump and motor run to restore hydraulic pressure in the accumulators, and allow pump to run until it automatically stops.
15. Place the SW1900-H in the up position to pressurize the hydraulic cylinder in the full open position.



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16. Remove the safety support brace. DO NOT place braces in Barrier Vault.

WEEKLY CLEANING & OPERATIONAL CHECK (CONTINUED)

17. Verify proper operation of vehicle presence detection loops, signal lights, barrier caution lights, alarm horns, if provided, and/ or all other safety devices integrated with the SW1900-H control system by cycling the barrier system at least 2 additional times.
18. Return SW1900-H control system to normal operating mode as directed by Guard Force and/or installation standard operating procedures.
19. Ensure all tools, equipment, and materials are accounted for and removed from the roadway. With client permission, remove traffic control and resume normal operation.



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MINOR PREVENTATIVE MAINTENANCE INSPECTION

1. Coordinate with the installation or facility representative to close traffic in the lane in which the SW1900-H is located, and in adjacent lanes as required. Ensure appropriate cones are placed in the roadway per local requirements.
2. Visually inspect the SW1900-H for any loose or missing hardware. Replace any missing hardware.
3. Remove all 3 Access Panels.
4. After ensuring the area is clear, cycle the SW1900-H and visually inspect all components during operation for any problems (i.e. hydraulic hoses surging or chafing, binding, unusual noises, or other indications of binding components, visible leaks)
5. Cycle the SW1900-H and visually inspect the HPU during operation for any problems (i.e. hydraulic hoses surging or chafing, any signs of hydraulic leaks, pump and pressure switch operation, proper valve operation).
6. Record all observations to ensure that repairs are completed later in this procedure or during follow-up scheduled repairs.
 - a. ***NOTE* Document all adjustments, component replacements, signs that components may be nearing the end of their life cycle, and other information for the purposes of trend analysis and developing recommendations for future service.**
7. Place SW1900-H in the full up position.
8. **Install safety support brace in accordance with Safety Brace Installation found in the Maintenance Introduction.**
9. Remove and secure electrical power at the disconnect within the HPU (see Safety - SW1900-H Shutdown). Drain hydraulic pressure completely from the accumulators and hydraulic hoses by triggering the manual dump valve. Comply with applicable lock-out tag-out procedures to ensure that power is not inadvertently restored or that the SW1900-H is not activated from any operator station.
10. Clean and remove any debris from the HPU Enclosure and the surrounding area.
11. Inspect all hydraulic hoses, fittings, and other components for wear, cracking or damage in the Vault area and HPU Enclosure. Ensure that there is no pressure indicated on the system before repairing any leaks, reinforcing or replacing damaged hoses, or adjusting fittings.
12. Clean and remove any debris from the Vault area, including the drain screens.
13. Open electrical junction box cover, inspect and repair any loose wiring connections in the Vault area, including heating element connections (if installed). Inspect proximity switches and cables.

14. Inspect for any indication of water penetration inside the junction box.

MINOR PREVENTATIVE MAINTENANCE INSPECTION (CONTINUED)

15. Properly secure all junction box covers when inspection and repairs or adjustments are complete.
16. Inspect all straps, retaining pins, and cotter pins for security, unusual wear, abrasion, or damage.
17. Inspect all cylinder pins and cotter pins for security, unusual wear, abrasion, or damage.
18. Inspect hydraulic cylinder, hoses, and fittings for signs of leakage, unusual wear, or damage.
19. Inspect the bearing blocks for signs of unusual wear. Document any residue on the bearing block that could indicate wear of the bearing surface.
20. Check integrity of sump pump discharge connection and remove any debris from the area.
21. Install all three (3) access cover plates and verify all hardware is properly tightened.
22. Inspect Vault area to verify that all components, hardware, hoses, and wiring is properly secured. Verify that the area is clear of all tools, cleaning materials, and any other debris.
23. Before removing lock-out tag-out devices, make sure all personnel are clear of the wedge area.
24. Remove lock-out tag-out devices in accordance with applicable regulations.
25. Restore electrical power at the disconnect and battery backup (if provided), verify the pump and motor run to restore hydraulic pressure in the accumulators, and allow pump to run until it automatically stops when pressure reaches the proper level (as shown in Figure 5 below). Note pressures during on/ off cycle in the service report for future reference and trend analysis.
26. Place the SW1900-H in the up position to pressurize the hydraulic cylinder in the full open position.
27. Remove the safety support brace. DO NOT place braces in the Barrier Vault.
28. Verify proper operation of vehicle presence detection loops, signal lights, barrier caution lights, alarm horns, and/ or all other safety devices integrated with the SW1900-H control system.
29. Test all barrier modes, operator panels, and safety interlocks provided.
30. Note and document SW1900-H cycle count in service report.
31. Return SW1900-H control system to normal operating mode as directed by Guard Force and/ or installation standard operating procedures.
32. Ensure all tools, equipment, and materials are accounted for and removed from the roadway. With client permission, remove traffic control and resume normal operation.

MAJOR PREVENTATIVE MAINTENANCE INSPECTION

1. Coordinate with the installation or facility representative to close traffic in the lane in which the SW1900-H is located, and in adjacent lanes as required. Ensure appropriate cones are placed in the roadway per local requirements.
2. Visually inspect the SW1900-H for any loose or missing hardware. Replace any missing hardware.
3. Remove all 3 Access Panels.
4. After ensuring the area is clear, cycle the SW1900-H and visually inspect all components during operation for any problems (i.e. hydraulic hoses surging or chafing, binding, unusual noises, or other indications of binding components, visible leaks).
5. Cycle the SW1900-H and visually inspect the HPU during operation for any problems (i.e. hydraulic hoses surging or chafing, any signs of hydraulic leaks, pump and pressure switch operation, proper valve operation).
6. Record all observations to ensure that repairs are completed later in this procedure or during follow-up scheduled repairs.

***NOTE* Document all adjustments, component replacements, signs that components may be nearing the end of their life cycle, and other information for the purposes of trend analysis and developing recommendations for future service.**
7. Place SW1900-H in the full up position.
8. **Install safety support brace in accordance with Safety Brace Installation found in the Maintenance Introduction.**
9. Remove and secure electrical power at the disconnect within the HPU (see Safety - SW1900-H Shutdown). Drain hydraulic pressure completely from the accumulators and hydraulic hoses by triggering the manual dump valve. Comply with applicable lock-out tag-out procedures to ensure that power is not inadvertently restored or that the SW1900-H is not activated from any operator station.
10. Inspect all hydraulic hoses, fittings, and other components for wear, cracking or damage in the Vault area and HPU Enclosure. Ensure that there is no pressure indicated on the system before repairing any leaks, reinforcing or replacing damaged hoses, or adjusting fittings.
11. Once proper spill prevention measures are in place, drain the hydraulic fluid from the reservoir.
12. Inspect internal components of the HPU for signs of wear or damage.
13. Remove and replace suction screen (at a minimum of once per year).
14. Remove and replace hydraulic filter (at a minimum of once per year).
15. Fill hydraulic reservoir tank with an approved hydraulic fluid (see list of approved hydraulic fluids in this manual) to proper level.
16. Clean and remove any debris from the Vault area, including the drain screens.
17. Remove electrical junction box cover, inspect and repair any loose wiring connections in the Vault area, including heating element connections (if installed). Inspect proximity switches and cables.

18. Inspect for any indication of water penetration inside the junction box.
19. Properly secure all junction box covers when inspection and repairs or adjustments are complete.

MAJOR PREVENTATIVE MAINTENANCE INSPECTION (CONTINUED)

20. Inspect all straps, retaining pins, and cotter pins for security, unusual wear, abrasion, or damage.
21. Inspect all cylinder pins and cotter pins for security, unusual wear, abrasion, or damage.
22. Inspect hydraulic cylinder, hoses, and fittings for signs of leakage, unusual wear, or damage.
23. Inspect the bearing blocks for signs of unusual wear. Document any residue on the bearing block that could indicate wear of the bearing surface. Ensure the bearing block cap bolts are secure.
24. Check integrity of sump pump discharge connection and remove any debris from the area.
25. Install all three (3) access cover plates and verify all hardware is properly tightened.
26. Inspect Vault area to verify that all components, hardware, hoses, and wiring is properly secured. Verify that the area is clear of all tools, cleaning materials, and any other debris.
27. Before removing lock-out tag-out devices, make sure all personnel are clear of the wedge area.
28. Remove lock-out tag-out devices in accordance with applicable regulations.
29. Restore electrical power at the disconnect and battery backup (if provided), verify the pump and motor run to restore hydraulic pressure in the accumulators, and allow pump to run until it automatically stops when pressure reaches the proper level. Note pressures during on/ off cycle in the service report for future reference and trend analysis.
30. Place the SW1900-H in the up position to pressurize the hydraulic cylinder in the full open position.
31. Remove the safety support brace. DO NOT place the braces in the Barrier Vault.
32. Test all barrier modes, operator panels, and safety interlocks provided.
33. Verify proper operation of vehicle presence detection loops, signal lights, barrier caution lights, alarm horns, if provided, and/ or all other safety devices integrated with the SW1900-H control system.
34. Note and document SW1900-H cycle count in service report.
35. Return SW1900-H control system to normal operating mode as directed by Guard Force and/ or installation standard operating procedures.
36. Ensure all tools, equipment, and materials are accounted for and removed from the roadway. With client permission, remove traffic control and resume normal operation.



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SW1900-H (HYDRAULIC) RECOMMENDED SPARE PARTS

Smith & Wesson recommends that the following spare parts be kept for use during the maintenance cycles.

PART NUMBER	PART DESCRIPTION	RECOMMENDED QNTY
609549	Supply Hose (with fittings)	1
609645	Suction Screen	1
609646	Hydraulic Fluid Filter	1
609649	Access Plate Bolts	4
500755	UHMW Pads	2
609680	Proximity Switches	2
609682	Proximity Cables	2
609647	#8 24VDC Coil	1
609648	#10 24VDC Coil	1



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WARRANTY

Limited Warranty:

GGT warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment by GGT, provided that the product owner presents GGT with written notice of any claimed defect within the applicable limited warranty period. If GGT is properly notified of a defect in materials or workmanship within the applicable warranty period, GGT's sole obligation will be to repair or replace the defective product or component part, at GGT's exclusive option, free of charge. Despite the previous provision, the product owner will be responsible for all costs associated with shipping any defective product or component part to GGT's corporate office in Franklin, Tennessee, and all costs associated with troubleshooting, diagnosing, uninstalling, or reinstalling any defective or replacement product or component part.

In addition, GGT's sole obligation to repair or replace any defective product or component part under this Limited & Exclusive Warranty is further subject to the following conditions: the product, if installed, was installed properly and correctly in accordance with the manufacturer's instructions; the product has been subjected only to normal and ordinary use and environmental conditions; the product has been properly and timely maintained and serviced in accordance with the manufacturer's recommended preventative maintenance and service schedule; the product has NOT been altered or used with parts not authorized by the manufacturer; and the product has NOT been subjected to misuse, abuse, vandalism, intentional damages, accident, neglect, or acts of God (including without limitation lightening, hail, wind, rain, or flooding). GGT has the right of final determination as to the existence and cause of any claimed defect. This Limited & Exclusive Warranty does not apply to normal maintenance or adjustments, normal wear, or consumable items (including without limitation lubricants, belts, filters, fuses, and light bulbs). Similarly, primer, paint, and other surface coatings are specifically excluded from this Limited & Exclusive Warranty. In the event any product failure is determined by GGT not to be the result of a defect in material or workmanship, the product owner shall pay for all costs incurred by GGT in troubleshooting, diagnosing, uninstalling, or reinstalling any product or component part at GGT's standard time and material rates.

THIS LIMITED & EXCLUSIVE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (EXPRESSED, IMPLIED, OR STATUTORY), REPRESENTATIONS, OBLIGATIONS, AND LIABILITIES – INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL GGT BE LIABLE FOR ANY: (A) INCIDENTAL, INDIRECT, SPECIAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES REGARDLESS OF THE FORM OF ACTION, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES; OR (B) DAMAGES OR INJURY CAUSED BY PURCHASER'S, PRODUCT OWNER'S, OR ANY OTHER PERSON'S MODIFICATIONS, REPAIRS, OR ALTERATIONS TO THE PRODUCT. PURCHASER'S FAILURE TO MAKE TIMELY PAYMENT IN FULL FOR THE PRODUCT(S) INVALIDATES THIS LIMITED & EXCLUSIVE WARRANTY. THE FOREGOING LIMITATIONS, EXCLUSIONS, AND DISCLAIMERS APPLY TO THE MAXIMUM EXTENT PERMITTED BY LAW.