

Original Instructions

Installation, Operation & Maintenance Manual

Sentry DS-3B Automatic Belt Sampler Point Samplers

S-LS-IOM-00303-8 9-16



COMPANY WITH
QUALITY SYSTEM
CERTIFIED BY DNV GL
= ISO 9001 =

 **SENTRY**



Do not install, maintain, or operate this equipment without reading, understanding, and following the appropriate Sentry Equipment Corp instructions. Otherwise, injury, damage, or both may result.

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Note

The information contained in this document is subject to change without notice.

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Safety Information

Please read the entire manual before attempting to unpack, set up, or operate this product. Pay careful attention to all Warnings, Cautions, and Notes. Failure to do so could result in serious personal injury and/or equipment damage.

Use of Hazard Information

If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

Definitions

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

NOTE

Information that requires special emphasis.

TIP

Alternate techniques or clarifying information.

SHALL: This word is understood to be mandatory.

SHOULD: This word is understood to be advisory.

General Safety Precautions

Product Selection, Installation, and Use

WARNING

Improper selection, installation, or use can cause personal injury or property damage. It is solely the responsibility of users, through their own analysis and testing, to select products suitable for their specific application requirements, ensure they are properly maintained, and limit their use to their intended purpose.

Follow proper local, state, and federal regulations for proper installation and operational requirements.

Always use caution and common sense when working with any chemical. Read the product label and Material Safety Data Sheets (MSDS) carefully and follow the instructions exactly.

Potential Equipment Hazards

WARNING

Hot surfaces! This equipment may have very hot surfaces. If an operator contacts a hot surface, injury may occur. Use protective clothing to prevent injury. If other equipment comes in contact with a hot surface, damage to the equipment may occur. Ensure the area around this equipment is kept clear to prevent damage from occurring.

High pressures! This equipment may contain fluids at very high pressures. Prior to installing, removing or maintaining this equipment, ensure that the equipment is isolated from all connecting piping, the equipment is depressurized, the contents have been drained, and the equipment is cool.

Moving parts! This equipment may contain moving parts. All drive guards and doors must be secured in place when this machine is being operated.

WARNING

Equipment rated TX. Equipment maximum surface temperature depends on operating conditions. Ensure maximum surface temperature shall stay below ignition temperature of dust or gas atmosphere where it is installed based on process conditions. Failure to comply could result in an explosion, causing serious injury or death to personnel and damage to equipment.

If the sampler is mounted directly to a non-electrically conductive surface, sampler shall be bonded to a grounding electrode. Failure to comply could result in sparking, which could lead to an explosion, causing harm to personnel and equipment.

If the sample container is removed from the sampler, do not insert any body part or other item into the sample discharge port. Crushing will occur.

NOTICE

To ensure proper sampler operation, be sure the sampler is installed in a pipe large enough for the sampler plunger to extend without impacting the pipe. Failure to comply will result in equipment damage and poor sample quality.

General Description

The Sentry® DS-3 sampler is a heavy-duty point sampler that automates sampling of materials such as grains from conveyors. A point sampler captures samples from a point in a process stream and often is used when the material is homogenous.

With an overall height of less than 24 inches (61 cm), the low profile Sentry DS-3 sampler mounts at any convenient point along a conveyor and allows for installation in areas with low headroom. The sampler arm and drive components are mounted within a steel enclosure. To obtain a sample, the scoop rotates through a conic sweep path, scooping a sample from the belt, which is then pitched and poured into a large stainless steel hopper that discharges to the side of the belt.

With representative sampling, characteristics of each sample match that of the entire lot or batch—so samples are repeatable, leading to accurate sample analysis data. Automatic sampling ensures a sample can be easily and safely obtained with no need for direct human interface or interference. This ensures sample integrity as well as operator safety.

The Sentry DS-3 sampler mounts using heavy, bridge-type supports. The sampler controller and discharge can be assembled to accommodate access from the right or left side of the conveyor. Arm speed is adjustable to suit belt speeds up to 900 FPM. The arm moves at a slightly faster speed in the same direction as the conveyor belt, collecting a sample without disrupting material.

The arm drive system is a rugged worm gear reducer in combination with a variable speed motor drive, which produces a wide range of flexibility in matching arm speed to the speed of the conveyor belt. Cycle rates are adjustable to sample at a maximum frequency of twice per minute.

Installation

Receiving

- Examine the crate and all contents for any shipping damage immediately after receipt.
- Take pictures of any suspected damage.
- Report damages to the delivery company at once. This is the responsibility of the consignee.

Selection of mounting location

1. Select a mounting location along conveyor frame where sampler, sample arm swing area, and sample collection container can be located without interference with existing structure. Remove or modify conveyor covers, etc., as necessary.
 - Material to be sampled should be as well mixed and homogenous as possible. Generally, locations close to in-feed end are better since segregation due to belt undulations is minimized.
 - Consider access for sample removal and scheduled maintenance.
 - Locate unit so that discharge chute opening is between a pair of conveyor idlers. This helps ensure that the scoop will not jam oversize material against belt in direct contact with an idler roller.
 - Avoid locations where an unloaded belt rises off its idlers and could potentially hit the sampler.
2. Orient the Sentry DS-3 belt sampler based on arm rotation direction.
 - DS-3 samplers are assembled and wired to mount on one side only of conveyor. Right hand (RH) units mount on the right side of conveyor; left hand (LH) units mount on the left side of conveyor. Right or left is determined when looking along the belt in the direction the material is moving.
 - DS-3 samplers can be field converted to the opposite orientation:
 - Remove the four (4) hex-head cap screws holding the scoop assembly to the arm.

- Reverse scoop by turning it 180 degrees and then reassemble.
- Reverse motor rotation by interchanging and two (2) of the three (3) incoming electrical power leads.

Sampler Mounting

Different installation techniques can be used to mount the sampler to the conveyor, depending on equipment and personnel available and job site, as well as intended sampler location. Two general procedures include offsite assembly and conveyor assembly.

Offsite Assembly

1. Assemble bridges (two U-shaped bridges will span conveyor side frames).
 - a. Use the Installation and Parts List drawing as a guide to assemble a 4" X 4" bridge angle with two corresponding 3" X 3" vertical legs using two 1/2-13 X 1-1/2" hex-head capscrews, washers, lockwashers and hex nuts per corner.
 - b. Assemble the second bridge unit.
 - c. Check to see that dimension between bridge legs (3" vertical angles) match width of conveyor frame exactly. Adjust if necessary, and then tighten fasteners securely.
2. Bolt sampler to bridges.
 - a. Pick up the sampler using an overhead sling through the lifting eyes on top of the sampler enclosure. Alternatively, a fork lift truck can be used beneath enclosure.

NOTICE

If a fork lift is used, ensure forks extend completely across base width. Do not allow forks to enter inside of enclosure as damage could result.

- b. Place U-shaped bridges under each end of suspended sampler. Align the holes in the bottom flanges of the sampler (3 each side) with the holes in the 4" X 4" bridge angles.
 - c. Bolt bridges to sampler using three 1/2-13 X 1-1/4" hexhead capscrews, lockwashers and hex nuts per side. Tighten fasteners securely.
3. Place sampler/bridges assembly over conveyor.
 - a. Use the lifting eyes on top of the sampler and a crane, overhead hoist, or a large lift truck, to hoist the sampler over the conveyor and lower the legs down over the conveyor until they slide past the conveyor side channels.
 - b. Lower until the bottoms of the legs are just flush with bottom edges of the side channels.
 - c. Check the dimension from the bottom of the bridge angle (4" X 4") to the top of the conveyor side channels. This dimension is found on Installation and Parts List drawing.
 - d. Use temporary clamps, (such as heavy C-clamps) to mount all four legs securely to the side channels.
 - e. Confirm that the bottom of the sampler is parallel to the conveyor frame and belt at the proper dimension as found on the Installation and Parts List drawing.
 - f. Ensure scoop is in full DOWN position. (Loosen two capscrews holding scoop to arm and ensure scoop is in LOWEST position, retighten capscrews.)
 - g. Proceed to the Final Positioning section below to set final height.

Conveyor Assembly

1. Assemble bridges (two U-shaped bridges will span conveyor side frames).
 - a. Using installation and parts list drawing as a guide, C-clamp four vertical legs (3" X 3" angles) to conveyor side frames. Be sure the leg bottoms are flush with the conveyor frame bottom.

- b. Check the dimension between the inside surfaces of legs on each side of the conveyor frame. Confirm to drawing dimensions and adjust if necessary.
 - c. Mount the 4" X 4" bridge angles to the vertical legs across the conveyor using two 1/2-13 X 1-1/2" hexhead capscrews, washers, and hex nuts per end.
 - d. Confirm that the center-to-center distance between the mounting holes of the bridge angles matches the distance between the mounting holes in the bottom flanges of the sampler. This dimension is shown on the drawing. Double-check by measuring your unit, and adjust as necessary.
2. Bolt sampler to bridges.
- a. Pick up the sampler using an overhead sling through the lifting eyes on top of the sampler enclosure.
 - b. Move sampler into position above bridge support rails and lower into position
 - c. Bolt bridges to sampler using three 1/2-13 X 1-1/4" hexhead capscrews, lockwashers and hex nuts per side. Tighten fasteners securely.
 - d. Confirm that the bottom of the sampler is parallel to the conveyor frame and belt at the proper dimension as found on the Installation and Parts List drawing.
 - e. Ensure scoop is in full DOWN position. (Loosen two capscrews holding scoop to arm and ensure scoop is in LOWEST position, retighten capscrews.)
 - f. Proceed to the Final Positioning section below to set final height.

Final Positioning

The sampler should be positioned parallel to the belt. Before making a permanent connection between support legs and conveyor frame, review the specific application. If practical, run a trial sample collection on the material before making a final, permanent connection. Keep following points in mind.

1. Do not position sampler so close to the belt that a full pile of material will hit the bottom of the unit.
2. For vertical clearance recommendations, see the Note section of the Installation Drawing.
 - There must be clearance between the scoop and the belt when the scoop is at the bottom of its arc.
 - Installed height of the sampler above the belt and the resulting penetration of the scoop into the material is determined after reviewing depth of the material on the belt as well as its density, abrasive characteristics, particle size, and distribution.
 - Maximum recommended penetration with light, non-abrasive materials is approximately 6 inches.
 - Recommended penetration into heavy, highly abrasive materials is approximately 3 inches.
3. With the scoop in its lowest position, the scoop must sufficiently clear the belt surface. (See the installation drawing for minimum dimension.)
4. When desired scoop penetration has been determined, check and set clearances as follows:
 - With no material on the belt, open drive enclosure and release motor brake. Brake release is controlled by a small lever at rear (or RH side) of motor/brake assembly (and away from drive pulley). Reach under the brake and turn the lever 90 degrees (one-quarter turn).
 - Rotate arm drive manually until scoop is at its closest point to the belt surface (scoop at right angle to belt).
 - Carefully shift the entire sampler and bridge assembly until the scoop clears the belt surface by needed penetration into a material pile, as determined by material characteristics.
 - When setting for maximum penetration (minimum clearance), be sure to make allowances for irregularities on the belt such as connection clamps, etc. Re-tighten temporary clamps before continuing.
5. Final adjustments of scoop depth is by slotted holes in scoop. Loosen the capscrews holding the scoop onto its carrier and slide the scoop to its final position. Approximately 7/8" of adjustment is provided in scoop slots.

6. (OPTIONAL) Adjustable Frame Modification (available only on belt samplers that included adjustable frame modification in original manufacture)
 - a. Coarse adjustment of 1" increments can be made by raising bridge members and re-positioning bolts in holes of legs using jackscrews to support components during lifting/lowering.
 - b. Check and set scoop final adjustment as described in step 5 above.

Final Mechanical Assembly

Belt area swept by sample arm must be adequately protected to prevent personnel or objects from contact during a sample collecting cycle. Appropriate interlocks preventing arm rotation when covers are open are included and must be used according to current safety regulations.

- Add additional guarding as necessary. Expanded metal mesh, sheet metal, belting, or similar material can be used to guard or enclose any area swept by the sampling arm when machine cycles.
- As a final check, manually rotate sampler arm through one complete revolution after guards, chutes, etc., are installed. Ensure scoop and arm clear all potential obstructions. Modify interference points for adequate clearance.
- Leave sampler on rigid (temporary) clamps during trial runs before making final connections onto conveyor frame. Upon completion of trials, weld 3" angle vertical legs to conveyor frames using 1/4" fillet welds on both sides (see Installation and Parts List Drawing).
- When mechanical assembly and height settings are finished, re-set motor brake before running sampler.
 - To check brake setting, pull V-belt by hand. If it does not move, brake is set.
 - If it is not set, arm and scoop will coast beyond its stopping point and will not operate satisfactorily.

Electrical Connection

Sampler is factory-wired for 230/460 V or 575 V, 3 ph, 60 Hz power supply. Optional voltages may be supplied; refer to tag attached to electrical control enclosure for specific voltage.

1. Bring electrical power leads into bottom of control enclosure. Use wiring methods and components that meet local wiring codes. Provide a suitable ground connection to control.
2. Machines wired for 230 V draw approximately 4 A; 460/575 V units require less than 2 A. A minimum 5 A service is typically used.
3. Always disconnect electrical power before inspection or maintenance of controls, drive, or any part of sampler.

Electrical Interlock

For safety of operating personnel and protection of sampler equipment, the sampler control must be interlocked to conveyor.

- If the sampler cycles while the conveyor belt is stopped, the arm can stall in the material, dropping out motor overload protection or blowing the circuit breaker/fuse. Once electrical power is lost, the motor brake sets and the arm is locked in material. If the conveyor restarts while the arm is stalled in this position, extensive damage can be done to sampler arm, gear reducer, motor brake and/or other components.
- Connect conveyor interlock between terminals 5 and 6 in the sampler control enclosure so that the sampler can only operate when the conveyor belt is moving. Refer to the circuit drawing included in this manual.

Operation

Adjustments

Direction of Arm Rotation

- When the sampler motor is turning in the correct direction, the sample scoop moves in the same direction as the belt when scooping at BOTTOM of arc. Refer to the Installation Drawing.
- If the motor is rotating in the wrong direction, interchange connections of any two of the three motor power leads.

Arm Rotation Speed

NOTE

Arm rotation speed should be approximately 10% faster than the speed of the belt. Arm speed should be checked and adjustments made while the belt is moving, but with no material on the belt.

Speed of arm rotation should be adjusted to pull the scoop through the material on the belt slightly faster than the material is moving. A speed difference of +10% is set at the factory. Compare the actual belt speed with the speed shown on the Installation Drawing.

To check and adjust arm speed, cycle the sampler and observe the relative speed between the tip of the scoop and the belt itself. Adjust arm speed (see below) until scoop speed is equal to belt speed. Then INCREASE scoop (arm) speed slightly, to approximately 10% faster than belt travel speed.

1. Approximate arm speed can be calculated and set relative to known/measured conveyor belt speed:
 - a. Use a stopwatch to check the time required for one complete revolution of the sampler arm. Then divide (666) by seconds for (1) revolution to approximate FPM (Feet Per Minute) of scoop tip.

$$\frac{11.1 \text{ ft/revolution} \times 60 \text{ sec}}{\text{Seconds/Revolution}} = \text{Arm Speed FPM}$$

- b. Check RPM (revolutions per minute) of the gear reducer output shaft where the sampler arm connects. Multiply 11.1 by measured RPM for approximate FPM (feet per minute) of scoop tip.

$$11.1 \text{ ft/revolution} \times \text{shaft RPM} = \text{Arm Speed FPM}$$

2. To adjust arm speed:
 - a. With electric power OFF, open drive enclosure.
 - b. Adjust arm speed by turning handle on drive motor mounting base.
 - Moving motor TOWARD arm drive gear reducer INCREASES arm speed.
 - Movement AWAY from gear drive REDUCES arm rotation speed.
 - Moving motor away from drive is safely accomplished by releasing motor brake lock and manually turning driven sheave while adjusting motor position.
 - If satisfactory sampling or discharge cannot be achieved after adjustments are made, contact factory.

Arm Dwell (Sample Discharge) Position

The most effective position for the scoop arm to stop and discharge each sample portion into the sample hopper will vary with belt speed (and corresponding arm speed) and the characteristics of the material being sampled.

Adjust arm dwell/stop position by changing the position of the cam that engages the limit switch on the upper shaft of the gear reducer within the drive enclosure.

- SLOW TO MEDIUM BELT SPEEDS—LIGHTER, (EASY-FLOWING MATERIALS):
 - Adjust arm to stop BEYOND vertical position (uppermost point of its arc).

- Stop point for slow belts carrying dry, easy pouring material can be as much as 10 to 15 degrees beyond the highest point of arm travel.
- MEDIUM BELT SPEEDS—SEMI-STICKY/WET MATERIALS:
 - Set arm to stop at vertical or just before it reaches vertical.
- HIGH BELT SPEED—STICKY/WET MATERIAL:
 - Set arm to stop 15 to 20 degrees BEFORE vertical, or just as it reaches the down-stream edge of the sample hopper.

Sampling Cycle Rate

The number of cycles taken over a specific period of time can be adjusted by a delay timer mounted in the control enclosure. Set the timer to the exact delay time between cycles to produce required sample quantity before exchange of sample container.

CAUTION

Close enclosure after making adjustments.

Digital Cycle Timer

For unusual timing requirements, a multimode electronic time delay relay is available with a setting range of 0.1 seconds to 1705 hours. The timing range is selectable with switches located on the face of the unit. Two LEDs indicate power and output status.

- **MODE:** Two-position DIP switches select various modes of operation. Ensure DOM (Delay ON Make) switch (A) is set to OFF position; all other Mode switches (B thru E) should be ON.
- **RANGE:** Three ON/OFF switches set seconds/minutes and multipliers of X0.1, X1, X10 or X100 to select 0.1 seconds to 1705 hours in 8 ranges.
- **TIME SETTING:** A vertical column of 10 two-position switches determine time delay. Left position of switches is OFF and right position is ON as marked. Along left side of column in line with switches are numbers typically representing seconds/minutes from top row of 1, 2, 4, 8, 16, 32, 64, 128, 256, and 512. Set time in seconds/minutes is total of numbers whose switches are in ON position; times range multiplier X0.1, X1, X10, X100 as selected.

EXAMPLE: Set 3 minutes (180 seconds):

- Two-position switch to SECONDS.
- Both multiplier switches ON; equals X1.
- DIP switches 128 + 32 + 16 + 4 ON = 180 seconds.

NOTE

DO NOT attempt to set a cycle rate of less than one minute with this timer as there will be insufficient time for control reset.

Digital Alarm Timer

- This 8-pin, plug-in timer provides a range of 0.1 to 102.3 seconds (1.7 minutes) maximum, adjustable in 1/10-second increments. Switch-set is adjusted by pushing slide switches on face of timer.
- **TIME SETTING.** A vertical column of 10 two-position switches determine time delay. Left position of switches is OFF and right position is ON as marked.
 - Convert total ALARM time desired to seconds.
 - Push switch “ON” for largest number which does NOT exceed desired time.
 - Subtract above selected number from total time required. Repeat until remainder is ZERO.

– EXAMPLE OF TIME SETTING:

For 3 seconds (start with all switches pushed to “OFF”).

Largest number less than 3.0 is “1.6”. Push “1.6” ON. Then as follows:

3.0 - 1.6 = 1.4 THEN Push “0.8” switch ON

1.4 - 0.8 = 0.6 THEN Push “0.4” switch ON

0.6 - 0.4 = 0.2 THEN Push “0.2” switch ON

0.2 - 0.2 = 0 Setting complete.

Total numerical value of switches pushed “ON” should equal exact off-time delay required in seconds.

[1.6 + 0.8 + 0.4 + 0.2 = 3 seconds]

NOTE

Cycle is delayed until warning horn timer “Times Out”. It may be necessary to set cycle frequency timer for slightly less than period desired.

Operating Control

WARNING

The alarm signal prior to initiation of automatic cycle is a warning to stand clear of the sampler. Instruct all operators, maintenance personnel and others in the area to immediately withdraw hands, tools or other objects which could be struck by sampling arm rotation when activated at alarm signal.

Rotating the “HAND-OFF-AUTO” switch to “OFF” does not disconnect electrical power within control enclosure. Use external disconnect switch when performing service work within belt sampler and control enclosures. Timer adjustments or other electrical testing that must be done with power “on” should be performed with caution by a qualified electrical technician.

With power to the control turned on, the belt running and access doors closed, rotate “HAND-OFF-AUTO” switch to AUTO. The red “ON” pilot light will illuminate, showing that the sampler is in operation and the OFF timer will start counting. If the belt stops, the OFF timer will hold the count and resume when the belt starts moving again. When the OFF timer “times out” a complete sampling sequence will be performed as follows:

1. Warning horn sounds for pre-set delay interval.
2. Arm makes one 360° sampling revolution.
3. Cycle delay timer resets to interval selected and begins timing delay until next cycle.
4. At completion of delay time, sampler will automatically repeat above sequence.
5. Rotate the “HAND-OFF-AUTO” switch to OFF to halt all further automatic operation and reset cycle delay timer.
6. To test arm rotation (initial set-up or maintenance), turn “HAND-OFF-AUTO” switch to HAND. Warning horn will sound until ALARM timer times out; then arm will start rotation.
7. To test arm rotational speed, continue to hold “HAND CYCLE” button down. Arm will continue to rotate as long as this button is held depressed.
8. Time delay (and warning horn cycle) prior to sample cycle is adjustable. It is controlled by a plug-in solid state timer included in control enclosure.

Sample Collection

WARNING

Do not operate the sampler with covers open. Before sampler is cycled, or whenever samples are to be taken, make sure personnel or objects are completely clear of arm sweep area. All guards MUST be in place and enclosures MUST be closed.

Sample portions removed from the conveyor belt are discharged through a hopper and into a sample collection container. Optional “open” and “closed” sample collection systems are available from factory for use on belt samplers.

- User Sample Collection: Normally, the user provides a container or drop chute to collect samples as discharged to hopper.
- Open Sample Collection System: An optional system includes a framework to support a 10-gallon metal sample collection container. Spare containers are available from factory.
- Closed Sample Collection System: An optional system (bagger group) used for moisture retention of incremented samples between collection periods. Samples are directed into a collection bag within the enclosure. See Bagger (Group) drawing provided.
 - Replacement Bags: Use “Hefty” brand 4 mil trash compactor bags, 2 X 2’11” (18 gallon) or equal. When installing bags, fold corners after mounting bag around discharge chute. Clip to U-shaped hanger. Bottom of bag (with fold) should rest in bottom of box when properly installed.
 - Retention chains should be in place across front of bag to keep it in a “normally closed” position.
 - Doors of enclosure should be kept closed to protect sample from environment.

Keep drive enclosure and control box covers tightly closed at all times (except for maintenance or inspection) to exclude dust, moisture, or unauthorized personnel.

Maintenance

WARNING

Disconnect electrical power before opening control enclosure for inspection or maintenance. Rotating the “HAND-OFF-AUTO” switch to “OFF” does not disconnect electrical power within control enclosure. Always use external disconnect switch when performing service work within belt sampler and control enclosures.

The Sentry DS-3B sampler is ruggedly built for years of reliable operation. Establish a regular inspection/maintenance schedule and replace worn components before complete failure occurs.

NOTE

A copy of the circuit is attached inside the door of the control. A copy of the circuit (group) drawing is included in this manual.

If the control fails to function and the pilot light does not come on, check fuses on panel inside enclosure. If a problem is not evident, it is recommended that a qualified electrician be called to service it.

Every 30 Days of Operation

1. Lubricate arm bearing. Scoop arm support bearing is equipped with a zerk-type grease fitting. Use a hand grease gun to re-lubricate with General Purpose Lithium Base grease. Locate bearing grease fitting by opening cover over sample hopper side of sampler. Always wipe dirt off fittings before adding grease.
2. For maintenance anticipate using four 14-ounce tubes of grease annually, 2–4 ounces per application.

Every 90 Days of Operation

1. Unscrew oil filler vent from housing of gear reducer. Ensure reducer housing is full to overflowing. Add Shell “VALVATA 182”/or Equal SAE 90 weight oil, if required. Always replace filler tube securely.
2. If more than a few ounces of oil are required, inspect reducer to determine if there is serious oil leakage.
3. Inspect drive belt for wear. Replace as necessary.

Every 6 Months or 2500 Operating Hours

1. Drain and refill gear reducer with Shell “VALVATA 182”/or Equal SAE 90 weight oil. Fill reducer until oil comes out top of fill (breather) plug (approximately 1 liter).
2. For maintenance anticipate using 2 to 3 liters of oil annually.

Standard Warranty

Sentry Equipment Corp (“Seller”) warrants products manufactured by it and supplied hereunder (“Products”) to be free from defects in workmanship and, to the extent materials are selected by Seller, to be free from defects in materials, in each case for a period as defined in the table below:

Product Line	Product Category	Warranty Period
Sentry®	1. Automatic Sampling 2. Corrosion Monitoring 3. Manual Sampling 4. Sample Conditioning 5. Sampling & Analysis Systems 6. Replacement Parts (without expiration dates)	Eighteen months from date of shipment or twelve months from startup, whichever occurs first
Waters Equipment	1. Sampling & Analysis Systems 2. Replacement Parts (without expiration dates)	Twelve months from date of shipment

To view the full warranty, go to www.sentry-equip.com/warranty.

Customer Support

With proven sampling expertise since 1924, Sentry products and services provide business operations the critical insights to optimize process control and product quality. We deliver true representative sampling and analysis techniques to customers around the globe, empowering them to accurately monitor and measure processes for improved production efficiency, output, and safety. Standing behind our commitments, we are determined to tackle any application, anywhere.

We know that running an efficient operation isn’t easy. It requires thorough, careful analysis of controlled, real-time data achieved through reliable, accurate, and repeatable process monitoring, and measuring. By effectively conditioning, sampling, and measuring gas, liquid, slurry, powder, solids, steam, or water within their production environments, our customers obtain the critical insights they need to control and optimize their processes.

Yet, controlling your processes also means reliable customer support throughout the life cycle of your equipment.

- Customer Service—General information, warranty claims, order management.
- Installation Service—For systems that require specialized expertise upon installation.
- Technical Support—Troubleshooting, training, and technical manuals.
- Field Service & Retrofits—When a problem needs immediate attention.
- Replacements Parts & Consumables—Order your replacement parts and consumables.
- Sentry ProShield Services – select from four ProShield Guardian service plans providing different levels of support to protect your large system investments with regularly scheduled maintenance.

To learn more, go to www.sentry-equip.com/support.

Appendix A: Time Calculations

Arm speed (in feet per minute) vs time (in seconds) for a single 360-degree revolution:

$$\text{Arm Speed FPM} = \frac{11.1 \text{ ft/revolution} \times 60 \text{ sec}}{\text{sec/revolution}}$$

$$\text{Arm Speed FPM} = 11.1 \text{ ft/revolution} \times \text{Shaft RPM}$$

Arm Speed (FPM)	Arm Speed (RPM)	Time (sec)
100	9.01	6.75
110	9.91	6.05
120	10.81	5.55
130	11.71	5.12
140	12.61	4.76
150	13.50	4.44
160	14.41	4.16
170	15.32	3.91
180	16.22	3.70
190	17.12	3.50
200	18.02	3.33
210	18.92	3.17
220	19.82	3.03
230	20.72	2.89
240	21.62	2.77
250	22.52	2.66
260	23.42	2.56
270	24.32	2.47
280	25.23	2.38
290	26.13	2.29
300	27.03	2.22
310	27.93	2.15
320	28.83	2.08
330	29.73	2.02
340	30.63	1.96
350	31.53	1.90
360	32.43	1.85
370	33.33	1.80
380	34.23	1.75
390	35.14	1.71
400	36.04	1.66

Arm Speed (FPM)	Arm Speed (RPM)	Time (sec)
410	36.94	1.62
420	37.84	1.58
430	38.74	1.55
440	39.64	1.51
450	40.54	1.48
460	41.44	1.45
470	42.34	1.42
480	43.24	1.39
490	44.14	1.36
500	45.05	1.33
510	45.95	1.31
520	46.85	1.28
530	47.75	1.26
540	48.65	1.23
550	49.55	1.21
560	50.45	1.19
570	51.35	1.17
580	52.25	1.15
590	53.15	1.13
600	54.05	1.11
610	54.95	1.09
620	55.86	1.07
630	56.76	1.06
640	57.66	1.04
650	58.56	1.02
660	59.46	1.01
670	60.36	.99
680	61.26	.98
690	62.16	.96
700	63.06	.95

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