



Maintenance Program

Code	Name	Station ID	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
For dedicated spare pumps & motors only	Pump	AYA	Horizontal pump between bearings	Bearings	bearing failure caused by false brinelling	High	Age-related	Rotate pump shaft 2-1/4 times	Every shift	Operator	Ensure that pump is isolated from power source
For dedicated spare pumps & motors only	Pump	AYA	Horizontal pump between bearings	Bearings	Bearing failure caused by contaminated oil	High	Random	Inspect oil for water contamination Regrease as necessary	Weekly	Maintenance contractor	
For dedicated spare pumps & motors only	Motor	AYA	Horizontal pump between bearings	Starter; Auto start system	Fail to start	High	Random	Start pump and run for at least 2 hours. Check all functionalities.	Monthly	Operator	Do this during visit by maintenance contractor.
WSO-AYAPR-0031	Discharge Valve SP4	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0009	Air Valve SP1	AYA	Air Valve	Actuator	Fail Open/Fail Close	Medium	Random	Overhaul pneumatic actuator & clean internals	Annually	Maintenance contractor	Assign task to OEM contractor.
WSO-AYAPR-0016	Air Valve SP2	AYA	Air Valve	Actuator	Fail Open/Fail Close	Medium	Random	Overhaul pneumatic actuator & clean internals	Annually	Maintenance contractor	Assign task to OEM contractor.
WSO-AYAPR-0023	Air Valve SP3	AYA	Air Valve	Actuator	Fail Open/Fail Close	Medium	Random	Overhaul pneumatic actuator & clean internals	Annually	Maintenance contractor	Assign task to OEM contractor.
WSO-AYAPR-0030	Air Valve SP4	AYA	Air Valve	Actuator	Fail Open/Fail Close	Medium	Random	Overhaul pneumatic actuator & clean internals	Annually	Maintenance contractor	Assign task to OEM contractor.
WSO-AYAPR-0008	Check Valve SP1	AYA	Check Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0015	Check Valve SP2	AYA	Check Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0022	Check Valve SP3	AYA	Check Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0029	Check Valve SP4	AYA	Check Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0034	Discharge Butterfly Valve 1	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0033	Discharge Pipe and Fittings	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0044	Fuel Storage	AYA	Tank	Tank wall & bottom	Leaks due to corrosion	High	Age-related	Inspect tank for leaks	Daily	Operator	Anytime during day shift.
WSO-AYAPR-0044	Fuel Storage	AYA	Tank	Tank wall & bottom	Leaks due to corrosion	High	Age-related	Clean tank & inspect bottom plates for corrosion	Every 2 years	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0010	Motorized Discharge Valve SP1	AYA	Motor Valve	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.



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WSO-AYAPR-0017	Motorized Discharge Valve SP2	AYA	Motor Valve	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0024	Motorized Discharge Valve SP3	AYA	Motor Valve	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0045	Overhead Travelling Crane	AYA	Lifting	Chain & gear mechanism	Failure of manual chain hoist due to wear & tear	High	Age-related	Inspect manual chain hoist for wear	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0045	Overhead Travelling Crane	AYA	Lifting	Motor drive	Motor burns due to failure of winding insulation	High	Random	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0005	Pipes and Fittings SP1	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0012	Pipes and Fittings SP2	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0019	Pipes and Fittings SP3	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0026	Pipes and Fittings SP4	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0004	Reservoir Blow-off Butterfly Valve	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0003	Reservoir Inlet Butterfly Valve 1	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head.	Every hour	Operator	Refer to pump specifications on minimum NPSH requirements. Follow company policy in dealing with cavitation issues (e.g. call MCC to increase suction pressure and/or shutdown pumps)
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Bearings	High vibration due to bearing failure (e.g. foreign materials in lubrication)	High	Random	Vibration monitoring	2-weekly (every 2 weeks)	Maintenance contractor	Use trained contractor for the appropriate vibration monitoring device. Report findings every month.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.



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WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Vibration dampers	Leaks due to deteriorated materials caused by fatigue	Medium	Age-related	Replace vibration dampers based on recommended life	Every 10 years	Maintenance contractor	Refer to recommended life of dampers by manufacturer. Otherwise, purchase spare damper before its recommended life to ensure availability when needed.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-AYAPR-0007	Storage Pump 1	AYA	Storage pump	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below <u>xx</u> head.	Every hour	Operator	Refer to pump specifications on minimum NPSH requirements. Follow company policy in dealing with cavitation issues (e.g. call MCC to increase suction pressure and/or shutdown pumps)
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Bearings	High vibration due to bearing failure (e.g. foreign materials in lubrication)	High	Random	Vibration monitoring	2-weekly (every 2 weeks)	Maintenance contractor	Use trained contractor for the appropriate vibration monitoring device. Report findings every month.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Vibration dampers	Leaks due to deteriorated materials caused by fatigue	Medium	Age-related	Replace vibration dampers based on recommended life	Every 10 years	Maintenance contractor	Refer to recommended life of dampers by manufacturer. Otherwise, purchase spare damper before its recommended life to ensure availability when needed.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-AYAPR-0014	Storage Pump 2	AYA	Storage pump	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below <u>xx</u> head.	Every hour	Operator	Refer to pump specifications on minimum NPSH requirements. Follow company policy in dealing with cavitation issues (e.g. call MCC to increase suction pressure and/or shutdown pumps)
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Bearings	High vibration due to bearing failure (e.g. foreign materials in lubrication)	High	Random	Vibration monitoring	2-weekly (every 2 weeks)	Maintenance contractor	Use trained contractor for the appropriate vibration monitoring device. Report findings every month.



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WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Vibration dampers	Leaks due to deteriorated materials caused by fatigue	Medium	Age-related	Replace vibration dampers based on recommended life	Every 10 years	Maintenance contractor	Refer to recommended life of dampers by manufacturer. Otherwise, purchase spare damper before its recommended life to ensure availability when needed.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-AYAPR-0021	Storage Pump 3	AYA	Storage pump	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below <u>xx</u> head.	Every hour	Operator	Refer to pump specifications on minimum NPSH requirements. Follow company policy in dealing with cavitation issues (e.g. call MCC to increase suction pressure and/or shutdown pumps)
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Bearings	High vibration due to bearing failure (e.g. foreign materials in lubrication)	High	Random	Vibration monitoring	2-weekly (every 2 weeks)	Maintenance contractor	Use trained contractor for the appropriate vibration monitoring device. Report findings every month.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Vibration dampers	Leaks due to deteriorated materials caused by fatigue	Medium	Age-related	Replace vibration dampers based on recommended life	Every 10 years	Maintenance contractor	Refer to recommended life of dampers by manufacturer. Otherwise, purchase spare damper before its recommended life to ensure availability when needed.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-AYAPR-0028	Storage Pump 4	AYA	Storage pump	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-AYAPR-0011	Storage Pump Motor 1	AYA	Motor	Motor winding	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-AYAPR-0011	Storage Pump Motor 1	AYA	Motor	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.



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WSO-AYAPR-0018	Storage Pump Motor 2	AYA	Motor	Motor winding	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-AYAPR-0018	Storage Pump Motor 2	AYA	Motor	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0025	Storage Pump Motor 3	AYA	Motor	Motor winding	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-AYAPR-0025	Storage Pump Motor 3	AYA	Motor	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0032	Storage Pump Motor 4	AYA	Motor	Motor winding	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-AYAPR-0032	Storage Pump Motor 4	AYA	Motor	Motor winding	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-AYAPR-0006	Suction Butterfly Valve SP1	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0013	Suction Butterfly Valve SP2	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0020	Suction Butterfly Valve SP3	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0027	Suction Butterfly Valve SP4	AYA	Valve	Valve disc & seat	Valve passing (leaks)	Medium	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve may cause problems during maintenance of pump/motor.
WSO-AYAPR-0001	Suction Pipes and Fittings	AYA	Piping	Flange	Leaks due to loose bolts and/or gasket failure	Medium	Age-related	Re-tighten bolts using specified torque values	Annually	Maintenance contractor	Use proper bolt tightening methods (e.g. manual, hydraulic, pneumatic, tensioning, etc.) Apply required bolt torque values.