

Asset Code	Name	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	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-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	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-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Test/measure motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	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-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	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-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0022	Storage Pump 1	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	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-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	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-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	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.

Asset Code	Name	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	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-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0033	Storage Pump 2	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	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-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	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-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	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-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	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-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0052	Booster Pump 1	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0062	Booster Pump 2	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0063	Booster Pump 2	Horizontal pump between bearings	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-PAGPS-0064	Booster Pump 2	Horizontal pump between bearings	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-PAGPS-0065	Booster Pump 2	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0066	Booster Pump 2	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0067	Booster Pump 2	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0068	Booster Pump 2	Horizontal pump between bearings	Suction isolating valve	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.

Asset Code	Name	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-PAGPS-0069	Booster Pump 2	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0070	Booster Pump 2	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0071	Booster Pump 2	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0072	Booster Pump 2	Horizontal pump between bearings	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-PAGPS-0073	Booster Pump 2	Horizontal pump between bearings	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-PAGPS-0074	Booster Pump 2	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0075	Booster Pump 2	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0076	Booster Pump 2	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	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-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	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-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	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-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	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-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0072	Booster Pump 3	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	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-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	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.

Asset Code	Name	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	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-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	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-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.
WSO-PAGPS-0082	Booster Pump 4	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	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-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	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-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Motor	Motor trip due to overloading	High	Random	Motor (skin) temperature measurement	Every hour	Operator	Refer to motor specifications on maximum allowable surface temperature.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Suction isolating valve	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-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Discharge isolating valve	Valve passing (leaks)	Low	Age-related	Test valve integrity	Annually	Maintenance contractor	Use qualified maintenance contractor. Failure of this valve is not critical as long as the check valve is working.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Pressure gauge (suction & discharge)	Pressure gauge reading is wrong due to wear	Low	Age-related	Replace pressure gauge	Annually	Maintenance contractor	Replace with calibrated pressure gauge. Mark with acceptable operating range. Criticality is low if the online pressure sensors are still functioning properly.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Pressure sensors (suction & discharge)	Pressure reading is erroneous	High	Random	Calibrate pressure sensors	Semi-annually (every 6 months)	Maintenance contractor	Use qualified maintenance contractor.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	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-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	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-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Impeller	Impeller wear	Low	Age-related	-Replace impeller -Inspect and measure clearances after every	-10 years -Annually	Maintenance contractor	Inspect during annual overhauls.

Asset Code	Name	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-PAGPS-0092	Booster Pump 5	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-PAGPS-0102	Booster Pump 6 - SPARE (dedicated)	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
WSO-PAGPS-0102	Booster Pump 6 - SPARE (dedicated)	Horizontal pump between bearings	Bearings	Bearing failure caused by contaminated oil	High	Random	Regrease as necessary	Weekly	Maintenance contractor	
WSO-PAGPS-0102	Booster Pump 6 - SPARE (dedicated)	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.

The list represents an initial recommended maintenance program for the mechanical (including motors and instruments) assets in Pagcor Pumping Facilities. The methodology used in its development is RCM (Reliability-Centered Maintenance). It is not intended to be the final list and should be treated as a "living" program. This simply means that it should always be reviewed and continuously improved over time. However, in doing this, the organization responsible for its sustainability should be aware of the methodologies and concepts used in RCM.

CRITICALITY MATRIX (Generic)

