



Maintenance Program

Code	Name	Station ID	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	Horizontal pump between bearings	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head (set by client) (set by client).	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-VIMPR-0011	Storage Pump SP1	VIL	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-VIMPR-0011	Storage Pump SP1	VIL	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	Horizontal pump between bearings	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head (set by client) (set by client).	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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.



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Code	Name	Station ID	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-VIMPR-0018	Storage Pump SP2	VIL	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-VIMPR-0018	Storage Pump SP2	VIL	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	Horizontal pump between bearings	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head (set by client) (set by client).	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-VIMPR-0029	Booster Pump BP1	VIL	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-VIMPR-0029	Booster Pump BP1	VIL	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	Horizontal pump between bearings	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head (set by client) (set by client).	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)



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Code	Name	Station ID	Asset Description	Component	Failure Mode	Criticality	Failure Pattern	Task	Frequency	Done by	Comments
WSO-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	Horizontal pump between bearings	System	General system leaks	Low	Random	Inspect system for leaks	Shift	Operator	Report excessive leaks for scheduled repairs.
WSO-VIMPR-0036	Booster Pump BP2	VIL	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-VIMPR-0036	Booster Pump BP2	VIL	Horizontal pump between bearings	Suction strainer	Blockage	Medium	Age-related	Clean strainer	Annually	Maintenance contractor	During annual overhauls.
WSO-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	Bearings	Loss of lubrication	High	Age-related	Scheduled greasing	Weekly	Maintenance contractor	Avoid overgreasing. Use correct grease as stipulated by bearing manufacturer.
WSO-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	Bearings	High vibration due to cavitation	High	Random	Monitor suction pressure not to go below xx head (set by client) (set by client).	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical 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-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	Packing	Excessive leaks	Medium	Age-related	Tighten packing bolts	2-weekly (every 2 weeks)	Maintenance contractor	Avoid overtightening of packing bolts.
WSO-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	Motor	Motor burns due to failure of winding insulation	Low	Age-related	Inspect motor winding insulation	Annually	Maintenance contractor	Use qualified maintenance contractor.
WSO-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical pump	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-VIMPR-0043	Booster Pump BP3	VIL	Vertical 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.