STAREX NTR-10: Mixing, Storage and Dosing Process

Standard Operating Procedure

1. Pre-Mixing Preparation

1.1. Inventory Assessment

1.1.1. Check existing tank levels

1.1.2. Estimate existing solution inventory by using following calculations

1.1.2.1. Assume tank's storage capacity = Y

1.1.2.2. Existing solution level = h meters

1.1.2.3. Total tank height = H meters

1.1.2.4. Existing volume of solution in storage tank = Y*(h/H)

1.1.2.5. Repeat above estimation for each storage tank

1.1.2.6. Add total volume of each storage tank to arrive at total solution inventory (say l liters)

1.1.2.7. Say, total storage capacity = L liters

1.1.2.8. Volume of solution to be prepared = (L – l) liters = V liters (say)

1.1.2.9. Solution concentration to be prepared = 25% of STAREX NTR-10 (1 part of NTR in 3 parts of water)

1.1.2.10. Specific gravity = 1.06 gm/mL

1.1.2.11. Total weight of solution to be prepared = V * 1.06 kg

1.2. Requirement Assessment

1.2.1.1. Total storage capacity = L liters (say)

1.2.1.2. Volume of solution to be prepared = (L – l) liters = V liters (say)

1.2.1.3. Solution concentration to be prepared = 25% of NTR (1 part of NTR in 3 parts of water)

1.2.1.4. Specific gravity = 1.06 gm/mL

1.2.1.5. Total weight of solution to be prepared = V * 1.06 kg = W kg (say)

1.2.1.6. Total quantity of NTR (powder) required = W/4 = w kg (say)

1.2.1.7. Total number of NTR bags required = w/25 = N (say)

1.2.1.8. Total capacity of Mixing Tank = M liters (say)

1.2.1.9. Total (suggested) water level per batch = 70% of M liters

1.2.1.10. Total number of bags of STAREX NTR per batch = M*70%*(1/3)/25 = n1 (say)

1.2.1.11. Total number of batches to be prepared in 1 day = 4

1.2.1.12. Total number of bags required per day (8 hours) = 4 * n1 = n (say)

1.2.1.13. Therefore:

1.2.1.13.1. N is the total number of bags of NTR required for the whole mixing process

1.2.1.13.2. n is the total number of bags of NTR required for the mixing process per day

1.3. Issuance of Goods from Stores

1.3.1. Request concerned plant official for issuance and transfer of NTR bags to the mixing tank location

1.3.2. Number of bags to be issued should be either N or n, depending on the plant's specific housekeeping and space constraints

1.4. House-Keeping Checks

1.4.1. Keep a tarpaulin sheet underneath the place where NTR bags will be kept.

1.4.2. Ensure there are no leakages in the pipelines or valves or pumps

1.4.3. Keep a separate bin for throwing the empty bags

1.5. Safety Checks

1.5.1. All labor, technicians and personnel involved in the mixing process should wear:

1.5.1.1. Elbow-length rubber gloves

1.5.1.2. Helmets, Safety Shoes and Safety Glasses

2. Mixing Process

2.1. Marking Water Level

2.1.1. Water level should be marked, typically, to 70% of total height of the mixing tank.

2.2. Filling Up Water

2.2.1. Before filling up water, check and confirm that the outgoing line valve is closed.

2.2.2. Water pump / line should be switched on and kept on till the tank is filled up to the desired water level marking made in step 2.1.1

2.3. Emptying Bags

2.3.1. Total quantity of NTR to be used in the batch should be confirmed as per the following calculation

2.3.1.1. Total capacity of mixing tank = M liters (say)

2.3.1.2. Total height of mixing tank = K meters (say)

2.3.1.3. Water level = k meters (say)

2.3.1.4. Water quantity in the mixing tank = M * (k/K) liters = m liters (say)

2.3.1.5. NTR quantity in the mixing tank = m/3 kg

2.3.1.6. Number of bags of NTR to be emptied in the tank = (m/3)/25

2.3.2. Number of bags emptied after each batch should be entered in the Table A provided in Documentation Section.

2.4. Agitation

2.4.1. Agitator should be switched on only after bags have been emptied into the mixing tank

2.4.2. Duration of agitation should be determined depending on the ambient temperature:

2.4.2.1. For temperature > 30 deg cel, duration should be 30 minutes

2.4.2.2. For temperature between 15 and 30 deg cel, duration should be 45 minutes

2.4.2.3. For temperature between 1 and 15 deg cel, duration should be 60 minutes

3. Storage

3.1. Solution prepared in the above process, should be transferred to storage tanks

3.2. Check and assess the storage tank levels before initiating transfer to avoid any possible overflows.

4. Dosage Drop Tests

4.1. Drop tests should be conducted once every shift to ensure accurate dosage of NTR solution into the cement mill feed

4.2. Table B in the following section should be used to cross-check dosages.

5. Documentation

5.1. Use Table A below to keep a check on number of bags being consumed

Table A (Sample; for customized Excel Spreadsheet, contact UNISOL representative)

Batch #	Storage Tank Level	Total Volume of Solution Required	Total Weight of Solution Required for Full Storage Capacity	NTR Quantity Required for Full Storage Capacity	Total # of NTR Bags Required	Total # of Bags Consumed in Current Batch	Cumulative # of Bags Consumed
	Liters	Liters	KG	KG	#	#	#
0	5000	25000	26500	6625	265	0	0
1	5000	25000	26500	6625	265	28	28
2	7642	22358	23700	5925	237	28	56
3	10283	19717	20900	5225	209	28	84
4	12925	17075	18100	4525	181	28	112
5	15566	14434	15300	3825	153	28	140
6	18208	11792	12500	3125	125	28	168
7	20849	9151	9700	2425	97	28	196
8	23491	6509	6900	1725	69	28	224
9	26132	3868	4100	1025	41	28	252
10	28774	1226	1300	325	13	13	265

Assumptions					
	1	Total Storage Capacity	30000	Liters	
	2	Specific Gravity of NTR Solution	1.06	gm/ml	
	3	Mixing Tank Capacity	3000	Liters	
	4	Water Level of Mixing Tank per Batch	2100	Liters	
	5	NTR Bags Consumption Per Batch	28		

5.2. Use Table B below to ensure correct dosage

Table B (Sample; for customized Excel Spreadsheet, contact UNISOL representative)

Dosage Chart for 25% NTR Solution (1 part STAREX NTR-10: 3 parts of water)					
Specific Gravity of NTR Solution (gm/cc):		1.06			
Recommended Dosage		0.025%			
Sr #	**Mill Output**	**Feed rate of NTR Solution**		**Drop Test Data**	
	TPH	**KG/Hour**	**Liters/Hour**	**KG/Min**	**mL/min**
1	180	45	42.5	0.75	708
2	185	46.25	43.6	0.77	727
3	190	47.5	44.8	0.79	747
4	195	48.75	46.0	0.81	767
5	200	50	47.2	0.83	786
6	205	51.25	48.3	0.85	806
7	210	52.5	49.5	0.88	825
8	215	53.75	50.7	0.90	845
9	220	55	51.9	0.92	865
10	225	56.25	53.1	0.94	884
Recommended Dosage		0.030%			
Sr #	**Mill Output**	**Feed rate of NTR Solution**		**Drop Test Data**	
	TPH	**KG/Hour**	**Liters/Hour**	**KG/Min**	**Liters/Min**
1	180	54.0	50.9	0.90	849
2	185	55.5	52.4	0.93	873
3	190	57.0	53.8	0.95	896
4	195	58.5	55.2	0.98	920
5	200	60.0	56.6	1.00	943
6	205	61.5	58.0	1.03	967
7	210	63.0	59.4	1.05	991
8	215	64.5	60.8	1.08	1014
9	220	66.0	62.3	1.10	1038
10	225	67.5	63.7	1.13	1061
Recommended Dosage		0.035%			
Sr #	**Mill Output**	**Feed rate of NTR Solution**		**Drop Test Data**	
	TPH	**KG/Hour**	**Liters/Hour**	**KG/Min**	**Liters/Min**
1	180	63.0	59.4	1.05	991
2	185	64.8	61.1	1.08	1018
3	190	66.5	62.7	1.11	1046
4	195	68.3	64.4	1.14	1073
5	200	70.0	66.0	1.17	1101
6	205	71.8	67.7	1.20	1128
7	210	73.5	69.3	1.23	1156
8	215	75.3	71.0	1.25	1183
9	220	77.0	72.6	1.28	1211
10	225	78.8	74.3	1.31	1238
Recommended Dosage		0.040%			
Sr #	**Mill Output**	**Feed rate of NTR Solution**		**Drop Test Data**	
	TPH	**KG/Hour**	**Liters/Hour**	**KG/Min**	**Liters/Min**
1	180	72.0	67.9	1.20	1132
2	185	74.0	69.8	1.23	1164
3	190	76.0	71.7	1.27	1195
4	195	78.0	73.6	1.30	1226
5	200	80.0	75.5	1.33	1258
6	205	82.0	77.4	1.37	1289
7	210	84.0	79.2	1.40	1321
8	215	86.0	81.1	1.43	1352
9	220	88.0	83.0	1.47	1384
10	225	90.0	84.9	1.50	1415

6. Equipment Handling and Maintenance

6.1. Agitator

6.1.1. Never run the agitator without adequate water quantity

6.1.2. Never run the agitator in air

6.1.3. Never run the agitator submerged in solid powder portion

6.2. Motor

6.2.1. Lubricate regularly according to manufacturer's instructions.

6.2.2. On sleeve-bearing and other oil-lubricated machines, check oil reservoirs on a regular basis.

6.2.3. In poor environments, change oil at least once a month.

6.2.4. Never over-lubricate; excess grease or oil can get into windings and deteriorate insulation. Be sure to use only the lubricant specified for the machine in question. However, one should also check into the possibility of using modern lubricants that have excellent life and lubricating qualities.

6.2.5. Bearing failures are one of the most common causes of motor failures. Typical bearing problems include improper lubrication, misalignment of the motor with the load, replacement with the wrong type bearing, excessive loading, and harsh environments.

6.3. Dosing Pumps

6.3.1. If the pump does not operate when turned ON:

6.3.1.1. Check the power supply and connections.

6.3.1.2. Check wiring color scheme.

6.3.2. If the pump operates but does not prime:

6.3.2.1. Check for a clogged or loose filter on the suction valve assembly. Retighten if necessary.

6.3.2.2. Check to see if the pump is too high above the foot valve assembly in the feed tank.

6.3.2.3. Check the pumphead, suction and discharge valves for blockage.

6.3.3. If pump flow rate is reduced:

6.3.3.1. Check the pumphead, discharge and injection valve assembly for any clogging. Clean and reassemble.

6.3.3.2. Check for any additional back pressure created since the last flow rate.

6.3.3.3. Check for any changes in the viscosity of the chemicals being used. Increase the % flow by adjusting the Flow Rate control to a higher setting and run a Flow Rate test.

6.3.3.4. Be sure that valves have been properly installed in the pumphead.

6.3.4. If there is leakage at the connections:

6.3.4.1. Be sure that the hose is fully seated and hose connectors are tight.

6.3.4.2. Be sure that valves are tight and O-rings are in place.

6.3.5. If there is leakage around the pumphead:

6.3.5.1. Be sure that the valves are tight and Orings are in place and the head screws are tight.