FTN
Water-reducing admixture for sprayed concrete

Description

FTN is a high range water-reducing admixture developed to improve the quality of sprayed concrete. Because sprayed concrete is executed under varying conditions, several major concerns in terms of durability, workability and economy, increased rebounds and slump loss etc. of sprayed concrete exist.

Major improvements in terms of workability, durability and economy of sprayed concrete can be achieved if FTN is added to the base concrete.

Uses

The amount of mix water can be greatly reduced for use in low-slump-loss concrete.

Three types of FTN admixtures are available:

- FTN-10 for use in general sprayed concrete.
- FTN-30 is the standard high range water-reducing admixture for high strength and high durability sprayed concrete;
- FTN-30S is a high range water-reducing and retarding admixture for high strength and high durability sprayed concrete.

Performance of FTN
Illustration of JIS A 6204 Performance Test Results

Specifications		AE Water Reducing Admixture Standard 'I' Type Standard Rate	FTN-10 Test Rate		High Range AE Water Reducing Admixture Standard 'I' Type Standard Rate	FTN-30 Test Rate		FTN-30S Test Rate	
			8cm	18 cm		8cm	18cm	8cm	18cm
Water Reduction Rate (%)		above 10	11	12	above 18	18	18	18	18
Bleeding Ratio (%)		above 70	62	60	below 60	18	18	18	18
Setting Time Difference (min)	Initial	-60 ~ +90	+55	+60	-30 ~ +120	+35	+35	+20	+25
	Final	-60 ~ +90	+50	+65	-30 ~ +120	+25	+25	+25	+40
Compressive Strength Ratio (%)	3 days old	above 115	130	128	above 135	151	152	153	154
	7 days old	above 110	125	126	above 125	141	143	147	148
	28 days old	above 110	118	116	above 115	132	129	132	132
Elongation Ratio (%)		above 120	100	100	below 110	99	99	99	99
Freeze-Thaw Resistance %		above 80	97	-	above 80	-	98	-	98
Variation Rate upon Time	Slump (cm)	-	-	-	below 6.0	-	2.5	-	1.5
Elapsed (60 mins later)	Air Rate (%)	-	-	-	within ±1.5	-	0.5	-	0.7

Admixture usage rate: FTN-10 = 10%, FTN-30=0.9%, FTN-30S=1.0%

Mortar Setting Test

Materials Used

Cement : Regular Portland Cement (mixture of 3 types)

Fine Aggregates :River Sand (specific gravity = 2.74, FM = 2.94)

Admixture : FTN-10, FTN-30, FTN-30S

Adhesive Material : Denka Natmic T-5 (all-purpose type), Denka Natmic T-10 (high strength type)

Mortar Mixture			
Admixture		**W/C**	**S/C**
Type	**Usage Rate (C x %)**	**(%)**	
No addition	-	57	2.5
FTN-10	1.0	50	
FTN-30 FTN-30S	1.5	40	

Fig.1A-Mortar Setting Times Natmic T-5

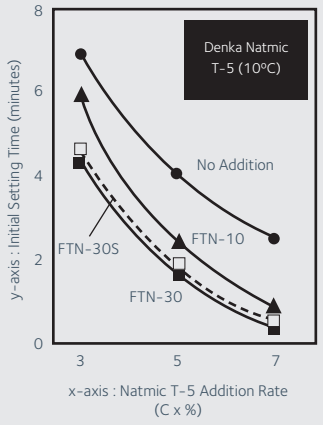


Fig.1B-Mortar Setting Times Natmic T-5

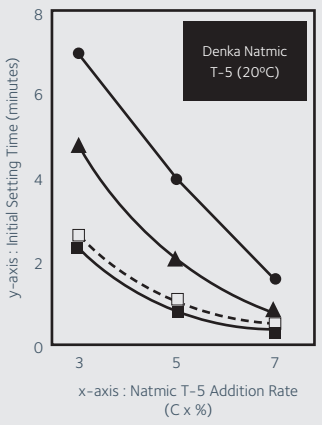


Fig.1C-Mortar Setting Times Natmic T-5

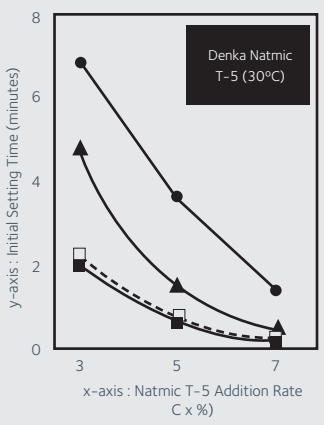


Fig.2A-Mortar Setting Times Natmic T-10

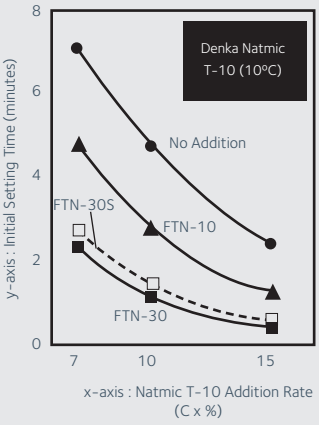


Fig.2B-Mortar Setting Times Natmic T-10

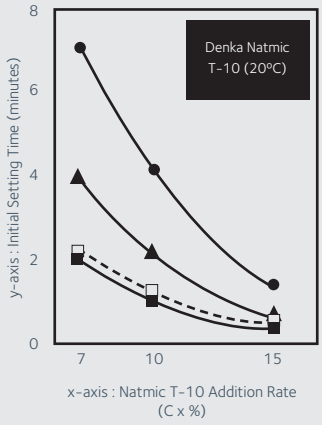
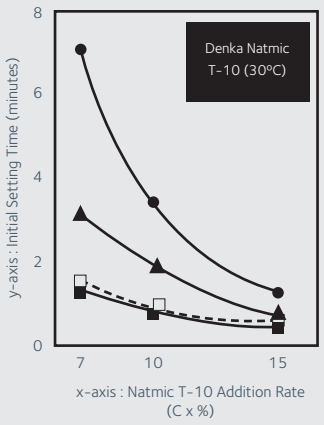


Fig.2C-Mortar Setting Times Natmic T-10



Test Conditions
Targeted flow rate was set at 210 ± 10mm after mixing for 15 minutes at 20ºC.
Tested based on same mixture at 20ºC for 10ºC and 30ºC.

Sprayed Test – High Strength Sprayed Concrete (1)

Materials Used

Cement : Regular Portland Cement (specific gravity = 3.16)
Fine Aggregates : River Sand (specific gravity = 2.74, FM = 2.94)
Coarse Aggregates : (specific gravity = 2.72)
Admixture :FTN-30
Adhesive Material: Denka Natmic T-5, Denka Natmic T-10

Properties of Concrete									
No.	W/C (%)	S/a (%)	Unit Weight (kg / m³)				Admixture FTN-30 (C x %)	Adhesive Material	
			W	C	S	G		Type	Addition Rate
(1)	40	60	180	450	1081	715	1.1	T-5	7
(2)								T-10	10

Characteristics Test Results									
No.	Characteristics of Base Concrete					Characteristics of Sprayed Concrete			
	Slump (cm) (upper row) Air Rate (%) (low row)			Compressive Strength (N/mm²)		Tensile Strength (N/mm²)		Core Strength (N/mm²)	
	Elapsed Time 0 min	60 mins	90 mins	7 days	28 days	3 h	24 h	7 days	28 days
(1)	18.5 2.3	17.0 2.2	14.5 2.0	48.6	56.8	2.9	12.5	38.5	42.4
(2)	18.0 1.9	16.0 2.2	13.5 1.9	46.6	56.6	4.3	18.0	45.2	57.9

Base Concrete Temperature : 18ºC

Sprayed Test – General Sprayed Concrete (2)

Materials Used

Cement : Regular Portland Cement (specific gravity = 3.15)
Fine Aggregates : River Sand (specific gravity = 2.73, FM = 2.90)
Coarse Aggregates : (specific gravity = 2.70)
Admixture : FTN-30S
Adhesive Material : Denka Natmic T-5

Properties of Concrete							
Type	W/C (%)	S/a (%)	Unit Weight (kg / m³)				Admixture Material (C x %)
			W	C	S	G	
No Admixture	63.9	60	230	360	1034	681	7.0
FTN-30S C x 0.9%	52.2	60	188	360	1102	727	7.0

Characteristics Test Results									
No.	Characteristics of Base Concrete					Characteristics of Sprayed Concrete			
	Slump (cm) (upper row) Air Rate (%) (low row)			Compressive Strength (N / mm²)		Tensile Strength (N / mm²)		Core Strength (N / mm²)	
	Elapsed Time 0 min	60 mins	90 mins	7 days	28 days	3 h	24 h	7 days	28 days
No Admixture	11.5 2.5	10.0 2.6	8.0 2.3	18.3	26.0	1.53	11.1	16.3	25.6
FTN-30S C x 0.9%	12.0 3.5	10.0 3.3	8.0 3.4	26.4	34.9	2.67	16.2	22.5	33.5

Base Concrete Temperature : 23ºC

Flowable Fill Test

Materials Used

Cement : Regular Portland Cement (specific gravity = 3.16)
Fine Powder : Fly Ash 100 mesh transit products (specific gravity = 2.70)
Fine Aggregates : Lime Crushed Sand /Fine Mortar (F.M = 2.85, specific gravity = 2.65)
Coarse Aggregates : Lime Crushed Stones/Mortar Stones (M.S = 15mm, specific gravity = 2.66)
Admixture : FTN-30S

Properties of Concrete									
Targeted Slump Flow (cm)	Targeted Demolding Time (hr)	W/C (%)	S/a (%)	Unit Weight (kg/m³)					Admixture FTN-30s (P x %)
				W	C	SF	S	G	
65 + 5	15	47.4	52.0	185	390	150	837	798	1.0

Characteristics Test Results								
Concrete Temp. (°C)	Slump (cm) (upper row) Air Rate (%) (low row)			Compressive Strength (N / mm²)				
	Immediately	30 mins	60 mins	90 mins	Age 15 hrs	Age 1 day	Age 7 days	Age 28 days
20	64.0 2.0	64.5 2.1	65.0 1.9	62.0 2.3	5.73	12.0	47.0	59.5

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Printed in Singapore | 04/16 | 200-TB-292

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