

# DENKA NATMIC Z-AF

Alkali-Free Powder Accelerator for Shotcrete

## Description

**DENKA NATMIC Z-AF** is an alkali-free powder accelerator for sprayed concrete based on calcium sulfoaluminate and can be used in civil engineering works such as road and railway tunnels, headraces, and mines. The accelerator is applied where initial rock support is needed or where a permanent lining will be placed.

## Features

- Rapid setting time and high initial strength are performed through ettringite formation in the initial hydration stage.
- Development of superior compressive strength after 28 days and excellent long-term durability.
- Good bonding to the ground surface and less rebound.
- Alkali free (Alkali ion content is less than 1%)

## Typical applications

- Rock support in underground spaces (tunnels, headraces and mines)
- Slope stabilization

## Technical data (Physical properties)

Color/Form	Grayish white/Powder
Mass density (20 °C, g/cm <sup>3</sup> )	2.40–2.95
Bulk density (20 °C, g/cm <sup>3</sup> )	0.80–1.30
Chlorine content (%)	<0.01
Alkali content (Na <sub>2</sub> O equiv. %)	<1

## Packaging

- 25 kg bags

## Mix proportions and accelerator-dosing position

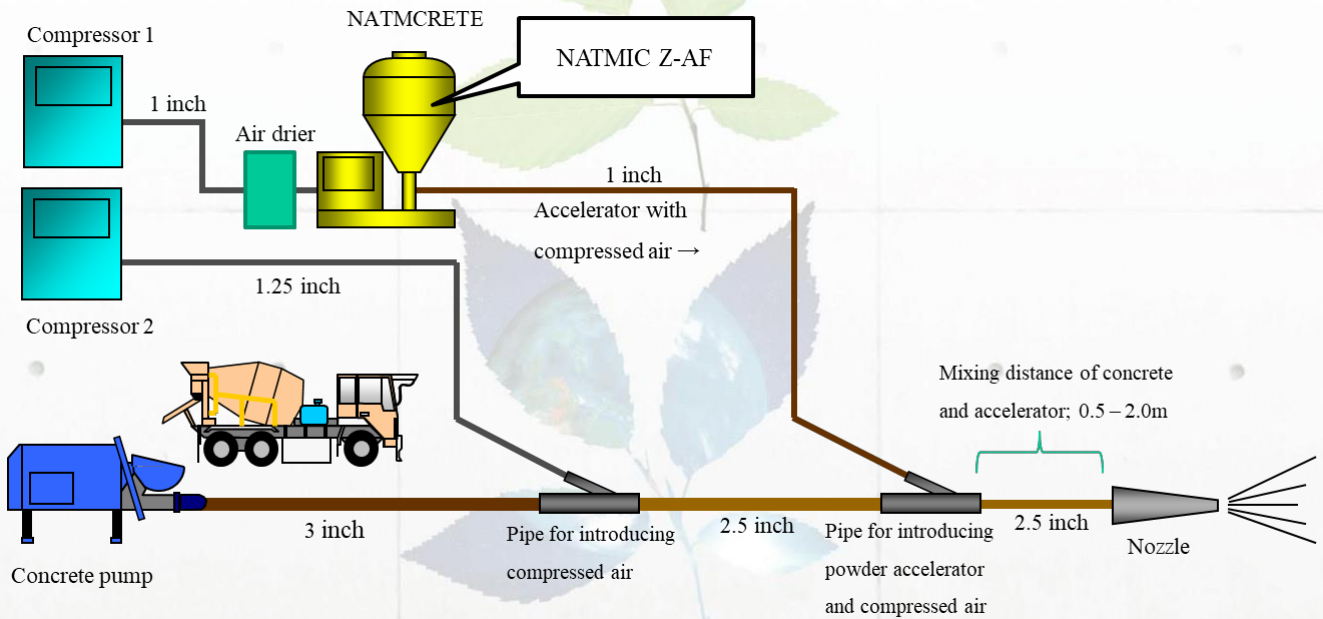
W/C	s/a	Unit content (kg/m <sup>3</sup> )				SP (Cementx%)	NATMIC Z-AF (Cementx%)
		Water	Cement	Sand	Gravel		
0.45	0.60	203	450	998	673	0.9	10

- W/C: Water-cement ratio, s/a: Sand-aggregate (sand and gravel) ratio
- Cement: Ordinary Portland Cement
- SP: Superplasticizer based on polycarboxylate

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- The dosage of DENKA NATMIC Z-AF depends on the temperature, cement reactivity, setting time, strength development, and required thickness of the layers.
- The dosage of DENKA NATMIC Z-AF ranges from 6% to 12% of the cement weight.
- The unit cement content is to be no less than 380 kg/m<sup>3</sup> and preferably be above 400 kg/m<sup>3</sup>.
- The water to cement ratio is to be below 0.5 and preferably no more than 0.45.
- The hose length between the nozzle and the dosing position of the accelerator should be 0.5–2.0 m.
- When DENKANATMIC Z-AF is used for concrete containing fly ash and/or silica fume, the setting time is likely shorter than that for clinker cement. Therefore, the hose length between the nozzle and the dosing position of the accelerator is to be adopted to less than 0.5



## Technical data (Setting and strength development)

### 1) Setting properties of accelerating mortar (example data)

Dosage of accelerator (%)	Initial setting (min.-sec.)	Final setting (min.-sec.)
8	0-55	10-00
10	0-45	1-45
12	0-35	1-00

<Mixing proportion of mortar>  
 Temperature: 20 °C  
 Water/cement ratio = 0.45  
 Cement: sand mass ratio = 1:2.5  
 Dosage of superplasticizer: 0.9% (vs. cement)

### 2) Compressive strength development of sprayed concrete (example data)

Compressive strength (MPa)			
3 hours	1 day	7 days	28 days
3.3	20.6	39.8	48.7

- These results were obtained in a spraying test using the wet-mix sprayed concrete having the above mixing proportion (Section 6).
- Properties of fresh concrete before spraying are slump of 195 mm and air content of 1.7%
- Compressive strengths after 3 hours and 1 day were calculated based on “pull-out test” value.
- Other compressive strengths were measured with a cylindrical specimen that was extracted by drilling from hardened sprayed concrete.

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## Precautions when handling

- Refer to the Safety Data Sheet (SDS) before use.
- Before spraying work, check the spraying system for abnormalities (e.g., check the piping, check for deterioration of the hose, and ensure the correct operation of all equipment).
- Optimize the dosage and dosing position of the product for the spraying process after spraying trials.
- Wear protective clothing and equipment (e.g., goggles, mask, gloves, and rubber boots) during handling.
- If piping is blocked with concrete or accelerator, clean the piping after completely releasing pressurized air from the piping. Do not look into the inside a hose.
- Do not dispose of DENKA NATMIC Z-AF drains.
- Keep the product in a place with low humidity when possible.
- The product in open bags should be used up completely or the bag should be resealed for storage.
- Use accelerator dosing equipment (DENKA NATMCRETE).
- For further information, please contact DENKA.

## Limitation of liability

- The information contained in this document is general advice for potential DENKA customers about the basic properties and characteristics of various DENKA products (hereafter referred to as "the Product Information"). DENKA provides no warranty and makes no representation as to the complete accuracy or completeness of the Product Information in this brochure.
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- DENKA reserves the right to change the Product Information from time to time at its discretion and without notice.

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### Denka Co., Ltd.

Special Cement Additives Department

TEL: +81-3-3507-5465 FAX: +81-3-3507-5085

### -Singapore-

DENKA CHEMICALS HOLDINGS ASIA  
PACIFIC PTE LTD

8 JURONG TOWN HALL ROAD

#07-01, THE JTC SUMMIT

SINGAPORE 609434

TEL:+65-6216-0580

FAX:+65-6224-3840

### -Malaysia-

DENKA CONSTRUCTION

SOLUTIONS MALAYSIA SDN BHD

NO.18, JALAN UTAS 15/7, SEKSYEN 15,

40200 SHAH ALAM,

SELANGOR DARUL EHSAN,

MALAYSIA

TEL:+603-5510-8810

FAX:+603-5518-8202

### -Europe-

DENKA CHEMICALS GMBH

WEHRHAHN-CENTER, CANTADOR STR.3,

DUSSELDORF, GERMANY

TEL: +49-211-130990

FAX: +49-211-329942

3B07JP