

# NMB SPlice SLEEVE SYSTEM

NMB  
SPlice SLEEVE

DEFORMED  
REINFORCING BAR  
SPICES

NMB  
D33  
12UX

01  
91921  
N

J.P.A.F.  
20294712  
10200905

20294712

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# Our company's primary focus to NMB Splice development of structural integrity and safety.

## NMB Splice Sleeve System, for Precast concrete and for Cast-in-place construction.

Developed in the late 60s in Hawaii, USA, engineered in Japan and renowned all over the world.

The first and only SA Class grout filled mechanical connector approved by BCJ (Building Center of Japan). SA Class is equivalent to Type 2 coupler approved by ICC-ES in the United States.

20 million sleeves used worldwide for over 40 years with no single fatality.

In March 2011, all building using NMB Splice Sleeve in the Tohoku area withstood the 9.0 Richter scale earthquake that shocked this area without any structural damage

All buildings with NMB Splice Sleeve withstood the Kobe-Osaka 7.9 Richter scale earthquake in 1995 without any structural damage.

No structures with NMB Splice Sleeve were damaged in Guam in 1993 in the 8.2 Richter scale earthquake.

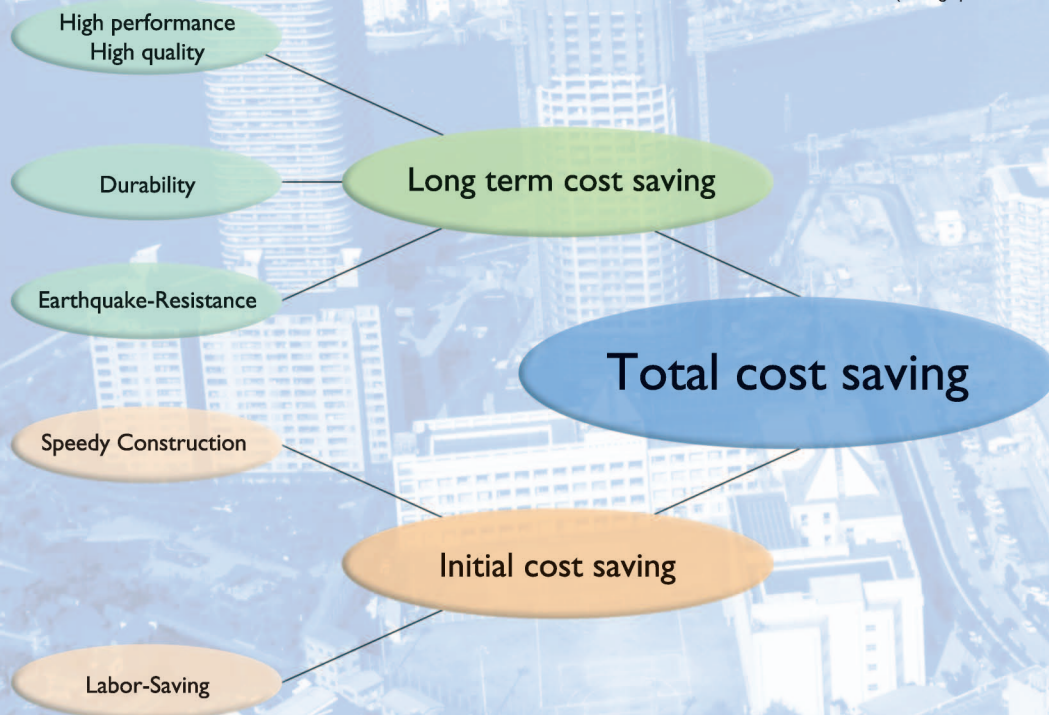
NMB Splice Sleeve System contributes to the industry in



Collapsed apartment building near the epicenter at Kobe, Japan (Photographed on Feb. 11, 1995)



Damaged-free apartment buildings constructed with NMB Splice Sleeve in the epicenter at Kobe, Japan (Photographed on Feb. 17, 1995)





# Sleeve System is catered for seismic resistance,



## What is the NMB Splice Sleeve System ?

The NMB Splice Sleeve is a mechanical coupler for splicing reinforcing bars which uses a cylindrical shaped ductile iron sleeve filled with a Portland cement based non-shrink high-early-strength grout (SS Mortar). Reinforcing bars to be spliced are inserted into the sleeve to meet approximately at the center of the sleeve.

The interior of the sleeve is then filled with SS Mortar grout.

The resulting splices will develop tensile and compressive strengths in excess of the specified minimum for JIS G3112, SD295A, SD295B, SD345, SD390 and SD490 rebar, as well as for ASTM A615 and A706, Grade 60 and 75 rebar conforming to the latest ACI 318 Building Code requirements, and for any reinforcing bar equivalent to those specifications throughout the world.

## What are the outstanding features of the NMB Splice Sleeve System?

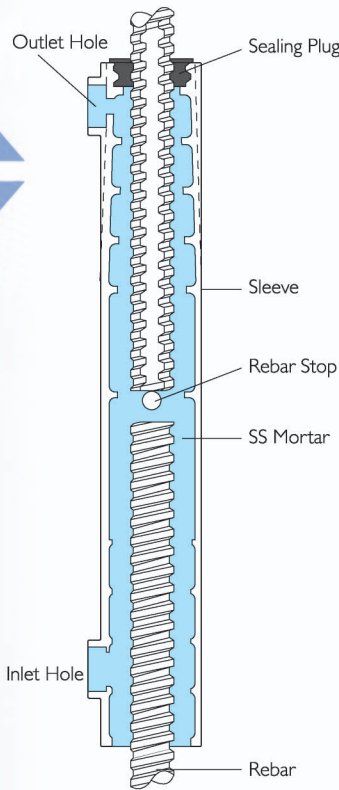
Splicing any type of deformation of reinforcing bar.

No shrinkage or No elongation reinforcing bar when spliced.

Accepting mis-aligned reinforcing bars with enough tolerance.



SS MORTAR



Over the years in the construction industry, engineers aspiring for better technology in building and civil engineering have given rise to an evolving NMB Splice Sleeve System.

# THE NEW CITY





## Exhibits high performance when used for Columns, Beams, Walls, and many other integral structural members.

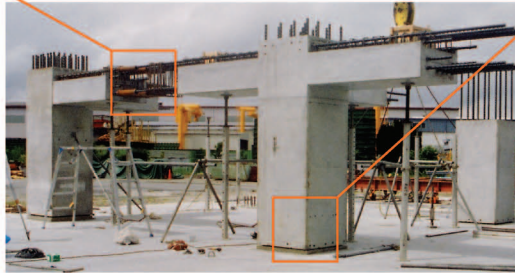
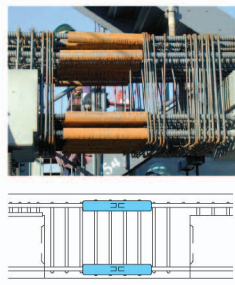
The product's superiority displays earthquake resistance and ease of construction. NMB Splice Sleeve System is widely used for connecting reinforcing bars in High-Rise, Super High-Rise buildings especially in earthquake-prone countries, like Japan.

Connecting Columns, Beams, Walls and other essential structural components for Super High-Rise Office Building / Apartment House, Hotel, School, Shopping Mall, Theater, Parking Garage, Stadium and Airport Control Tower.

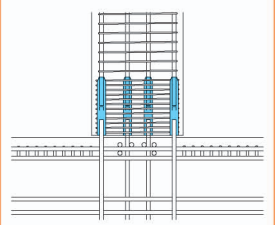
### Column/Beam

#### Precast

Slim Sleeve for connecting Precast beams



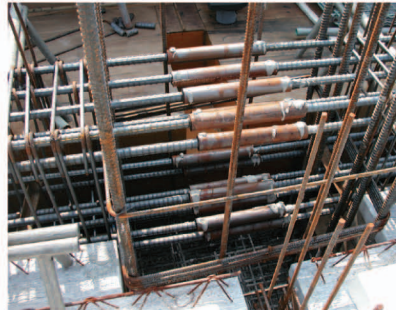
Super UX, NX II Sleeve for Precast column



#### Cast in place



Slim Sleeve for connecting rebar cage



Slim Sleeve for connecting beam rebar

### Wall

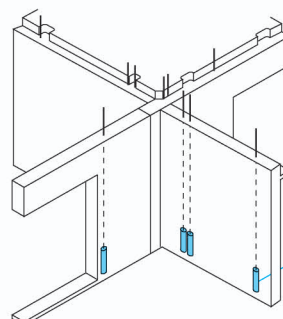
#### Precast



High-Rise apartment



Precast concrete wall



Super UX, NX II Sleeve in Precast wall





**Used in Sound Barrier Walls, Box Culverts, Retaining Walls, Bridges, Caissons and a growing number of other civil engineering projects.**

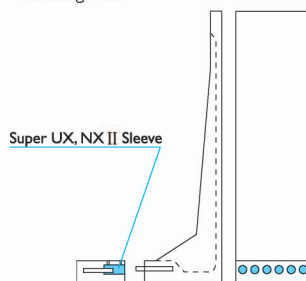
The high performance of the NMB Splice Sleeve System provides solid support for civil engineering projects.

Bridge Pier, Sound Barrier Wall, Retaining Wall, Caisson,  
Concrete Box Culvert, Concrete Barge.

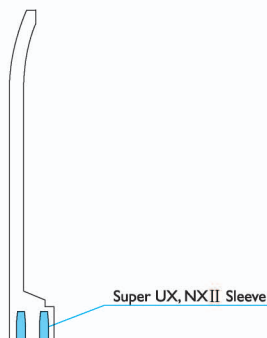
## Sound Barrier and Retaining Wall / Precast



Retaining Wall



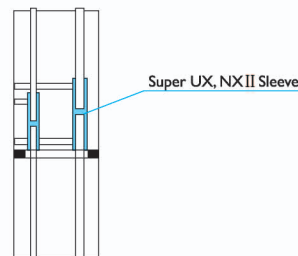
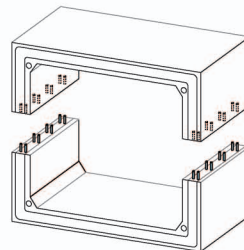
Sound Barrier Wall



## Box Culvert / Precast



Box Culvert



## Reinforcement / Cast-in-place



Bridge Pier Reinforcement

## Bridge / Cast-in-place



Akashi Channel Bridge



Akashi Channel Bridge, Anchorage



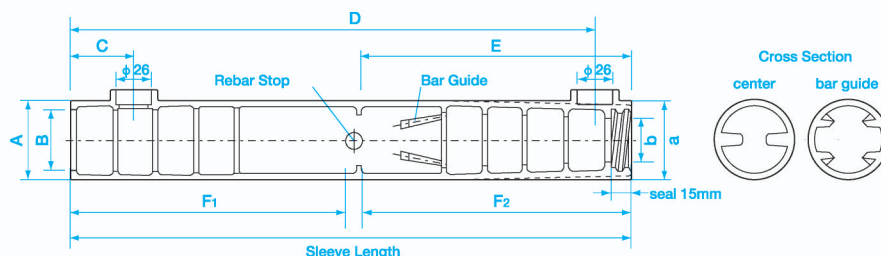
Bridge Pier



# SPLICE SLEEVE SELECTION

Available in various types / sizes for use in a wide range of building and

## Super UX / NX II Sleeve for Precast construction...



### Building Application:

- Super High-Rise, High-Rise & Mid-Rise apartment
- Shopping center
- Office building
- Schools
- Sound barrier & Retaining wall
- Concrete box culvert

Sleeve	Grade	Rebar Size	Features
Super UX Sleeve	SA Class A Class	D16~D41 SD295A·B~SD490	Accepting mis-aligned rebars
NX II Sleeve	A Class	D16~D22 SD295A·B~SD390	No shrinkage or elongation of sleeves

Sleeve	Rebar Size (JIS)	Sleeve Length (mm)	Sleeve Diameter (mm)			Inlet Position (mm) (C)	Outlet Position (D) (mm)	Rebar Stop (E) (mm)	Rebar Embedment (mm)		Grout Consumption (pcs/ 15kg bag)
			O.D.(A <sub>2</sub> ) (mm)	I. D.					Wide End (F <sub>1</sub> )	Narrow End (F <sub>2</sub> )	
				Wide End (B)	Narrow End (b)						
5UX(SA)	D16	245	45	32	22	47	218	115	90~120	105~115	29
6UX(SA)	D19 *(D16)	285	49	36	25		258	135	110~140	125~135	22
7UX(SA)	D22 *(D16~D19)	325	53	40	29		298	155	130~160	145~155	17
8UX(SA)	D25 *(D19~D22)	370	58	44	31		343	175	150~185	165~175	13
9UX(SA)	D29 *(D22~D25)	415	63	48	35		388	200	175~205	190~200	10
10UX(SA)	D32 *(D25~D29)	455	66	51	39		428	220	195~225	210~220	9
11UX(SA)	D35 *(D29~D32)	495	71	55	44		468	240	215~245	230~240	7
12UX(SA)	D38 *(D32~D35)	535	77	59	47		508	260	235~265	250~260	6
13/14UX(SA)	D41 *(D35~D38)	620	82	62	51		593	300	275~310	290~300	4
5-NXII	D16	220	44	32	22	47	193	105	80~110	95~105	35
6-NXII	D19 *(D16)	250	48	36	25		223	120	95~125	110~120	27
7-NXII	D22 *(D16~D19)	280	52	40	29		253	135	110~140	125~135	22

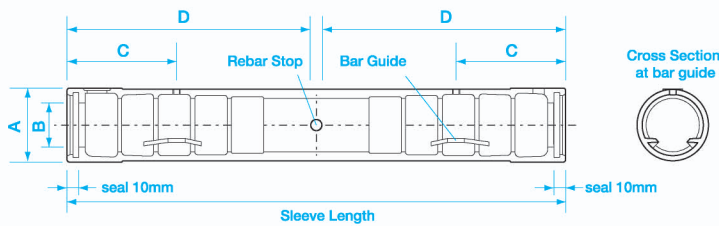
\*( ) indicates transition splice



# SPLICE SLEEVE SELECTION

civil engineering projects from Super High-Rise Buildings to Bridges.

## Slim Sleeve for Cast-in-place...



### Building Application

- Rebar cage to rebar cage connection
- Connecting beam reinforcing bar

Sleeve	Grade	Rebar Size	Features
Slim Sleeve	A Class	D19~D51 SD295A·B~SD490	Easy to connect No shrinkage or elongation of sleeves

Sleeve	Rebar Size (JIS)	Sleeve Length (mm)	Sleeve Diameter (mm)		Bolt for fixing (C) (mm)	Rebar Stop (D) (mm)	Rebar Embedment (mm)	Grout Consumption (pcs/15kg bag)
			O.D. (A)	I.D. (B)				
S8U	D25 * (D19~D22)	330	48	31	60	160	150~165	31
S9U	D29 * (D22~D25)	370	54	35	90	180	170~185	24
S10U	D32 * (D25~D29)	410	59	39	90	200	190~205	18
S11U	D35 * (D29~D32)	450	65	43	90	220	210~225	14
S12U	D38 * (D32~D35)	490	71	47	90	240	230~245	10
S13U	D41 * (D35~D38)	550	76	51	120	270	260~275	8
S16U	D51 * (D41)	710	92	62	150	350	340~355	8

\*( ) indicates transition splice

## CLASSIFICATION OF JOINT PERFORMANCE BY BUILDING CENTER OF JAPAN

Grade SA joint: The strength, rigidity and ductility are almost equivalent to those of rebars to joint

Grade A joint: The strength and rigidity are almost equivalent, but the ductility is slightly inferior to those of rebars.

Grade B joint: The strength and rigidity are almost equivalent, but the other characteristics are inferior to those of rebars.

Grade C joint: The strength, rigidity etc. are inferior to those of rebars.





**The NMB Splice Sleeve System is specially designed to facilitate construction at job site and greatly reduces construction period.**

Rebars are inserted into the set sleeve and SS Mortar grout is easily injected into the sleeve. This method does not require special skills and makes construction easy, helping to reduce project costs, due to the reduced construction period.

## Super UX / NX II Sleeve

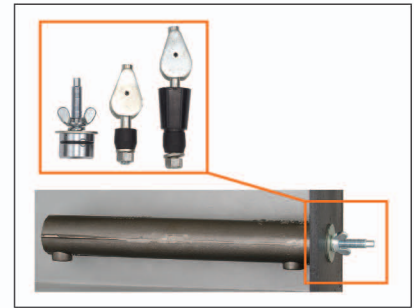
### Assembling Precast Wall and Beam



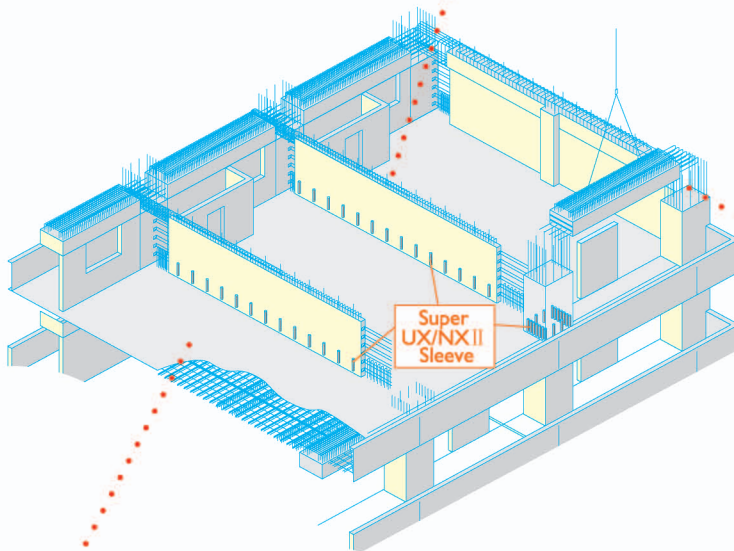
Precast wall before pouring concrete



Precast wall member



Sleeve Setter



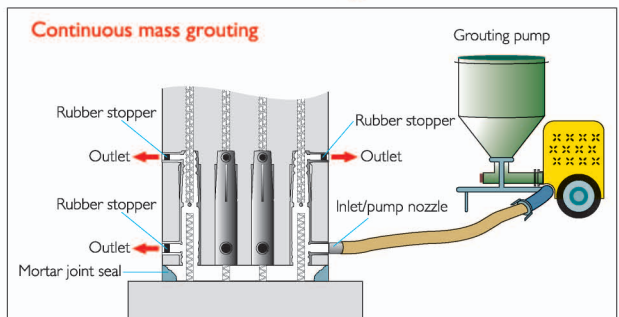
Super UX/NX II Sleeve



Assembling rebar cage for precast column



Erecting precast column





## Slim Sleeve

### Assembling Precast Beam



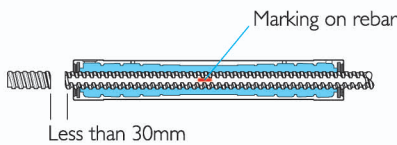
Sliding Slim Sleeve onto rebar



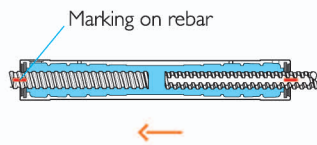
Sliding back to the center



Placing stirrup



Sliding Slim Sleeve to one side

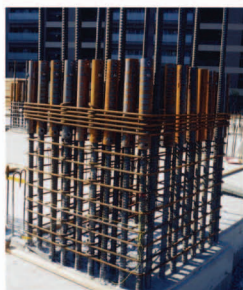


Sliding back to the center



Injecting SS Mortar

### Assembling Rebar Cage for Column



Placing Slim Sleeve onto rebar



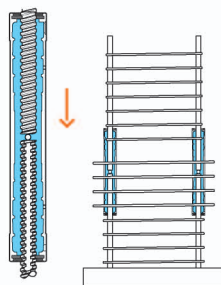
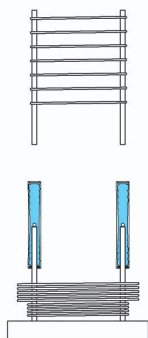
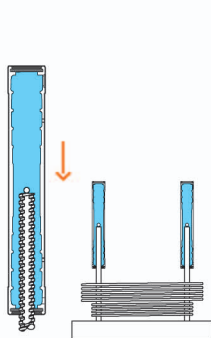
Lowering upper rebar cage



Placing hoop



Injecting SS Mortar



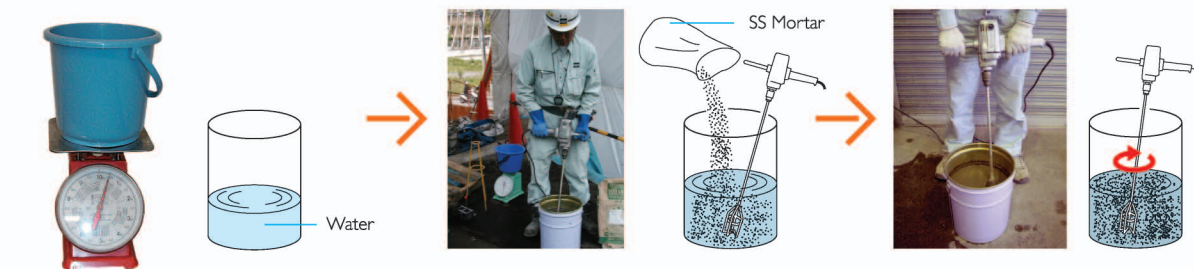


## SS Mortar grout will develop the full performance of NMB Splice Sleeve System

SS Mortar grout is a non-shrink, high-early-strength cement grout developed for use with the NMB Splice Sleeve System. The flowable grout can fill the chamber of sleeve thoroughly. It comes pre-mixed with select blended materials for easy management at the building site.



### Mixing



#### 1) Description

SS Mortar, the grouting material specified by code is a pre-mixed formulation developed for specific use with the NMB Splice Sleeve. It provides the following special features:

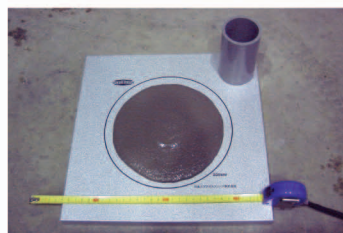
- High Early Strength ..... Approximately 30 N/mm<sup>2</sup> in 24 hours
- High Ultimate Strength ..... Approximately 100 N/mm<sup>2</sup> in 28 days
- Flowability
- Non-shrink
- Pre-Mixed Formulation

#### 2) Mixing

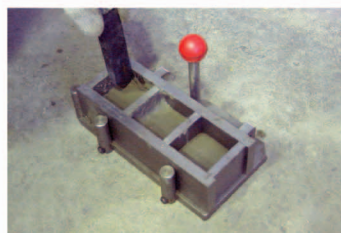
SS Mortar is delivered in 15 kg bag in a ready-to-use formulation, requiring only the proper amount of water and time to assure a uniform mix of stable quality and specified performance.

### Test

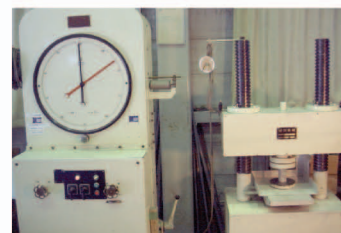
#### Compressive Strength Test



Flow Guide Table



Cubic Mold (5×5×5 cm)



Compressive Strength Test

#### Quality Control

	Super UX/ Slim Sleeve	NXII Sleeve
Amount of water/bag of 15kg	2.1 - 2.3 Litre	
Mixing time	Approximately 2 minutes	
Consistency (Flow Guide Table)	155-235mm diameter	
Ambient temperature	0°C - 60°C	
Pot Life	Approximately 40 minutes after mixing	
Compressive strength (28 days by cubic mold)	77 N/mm <sup>2</sup>	77 N/mm <sup>2</sup>

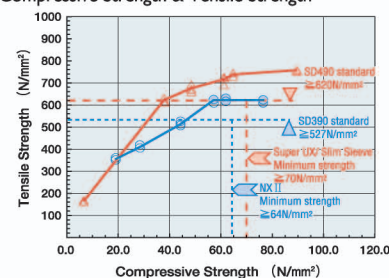
#### Example of the test result for fresh SS Mortar

Amount of water (per bag)	Consistency (Dia. by Flow table)	Mixed temp.	Curing temp.	Bleeding ratio	Setting time (Hour-Min.)	
					Initial	Final
2.2 liters	180 mm	20 °C	5 °C	0 %	9—31	13—35
			20 °C	0 %	4—18	5—55
			30 °C	0 %	2—23	3—20

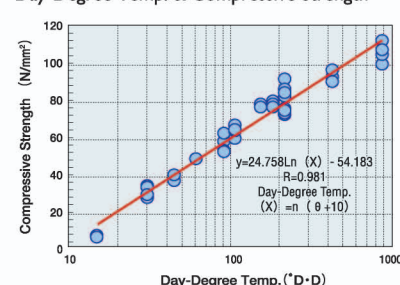
#### Example of the test result for hardened SS Mortar

Consistency (Flow table)	Curing temp	Compressive Strength (N/mm <sup>2</sup> )					
		12 hours	18 hours	1 day	3 day	7 day	28 day
180 mm	5 °C	—	4.0	10.1	42.2	56.5	86.3
	20 °C	5.6	20.2	30.5	55.2	71.1	100
	30 °C	18.5	36.0	49.0	68.5	79.1	101

#### Compressive Strength & Tensile Strength



#### Day-Degree Temp. & Compressive Strength



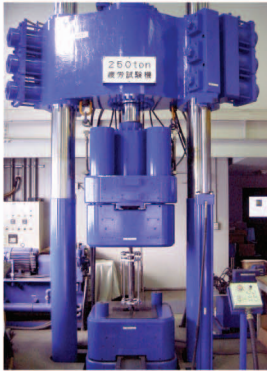




**The NMB Splice Sleeve System is highly proven reliable through various and many extensive tests.**

Tests for strength, rigidity, ductility and other performance characteristics are carried out using advanced test equipments at Nissco Technical Center (NTC).

Testing equipments  
at Nissco Technical Center



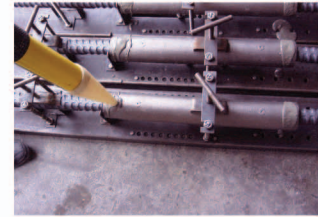
250 ton Fatigue testing machine



Setting time test



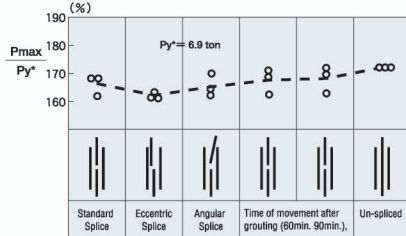
Hydraulic compression testing machine



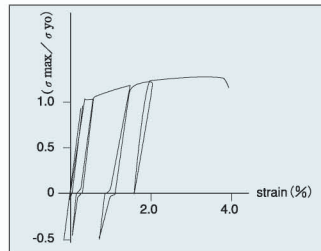
Assembling test specimens in the temperature controlled curing room

Technical Data

Effect of misalignment of bars and disturbance after grouting (%)

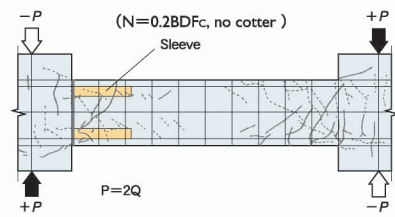
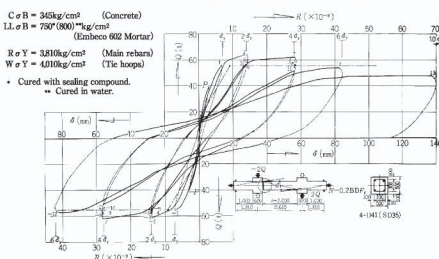


Elastic and plastic cyclic test (SD490 D41)

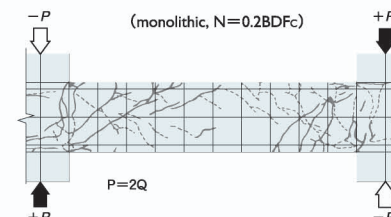
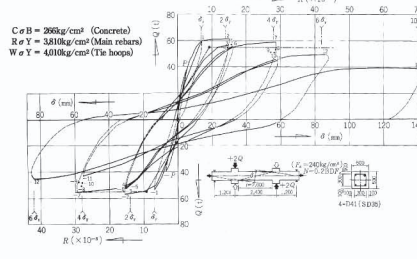


**Structural tests on full size column and beam**

Q-δ Curve (N= 0.2BDFC, spiral hoop) with NMB Splice Sleeve



Q-δ Curve (monolithic, N= 0.2BDFC) without NMB Splice Sleeve



Structural test on full size column with high strength rebar, cement and NMB Splice Sleeve



$F_c = 60 \text{ N/mm}^2$   
SD 490 rebar  
axial force ratio (N/No) = -0.7 - +0.5  
loading direction: 45°

**Fatigue resistance test**

The fatigue resistance of Splices with 2 million-stress cycles provides approximately 18kgf/mm<sup>2</sup> (minimum stress, min.=1.97kgf/mm<sup>2</sup>), which is 80 % of the strength of un-spliced rebar with 2 million-stress cycles.

**Fireproof performance test**

- ① No deterioration of the splicing performance was observed after the fire exposure, reaching up to 400 °C on NMB Splice Sleeves uncovered by concrete.
- ② No deterioration of the splicing performance with 20 mm concrete coverage for 3 hours fire exposure at 1,200 °C was observed.



## The NMB Splice Sleeve System is used worldwide



Espaldas Pipe Rack, Ecuador



Saudi Arabia Monetary Agency, Saudi Arabia



Toa Payoh, Singapore



Marina Residence, Dubai



San Mateo Bridge, USA



Soho Apartment, New Zealand



Nishi Ikebukuro, Japan



Shopping Center Japan



MGM Hotel, USA



Mystic Garage, USA



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