NMB
SPLICE SLEEVE SYSTEM

NMB SPLICE SLEEVE

DEFORMED REINFORCING BAR SPLICES

SINGAPORE GREEN BUILDING PRODUCT
S G B C

VERY GOOD
SGBP 5114

Singapore

Our company's primary focus: 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.

More than 22 million sleeves used worldwide for over 40 years with no single fatality.

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

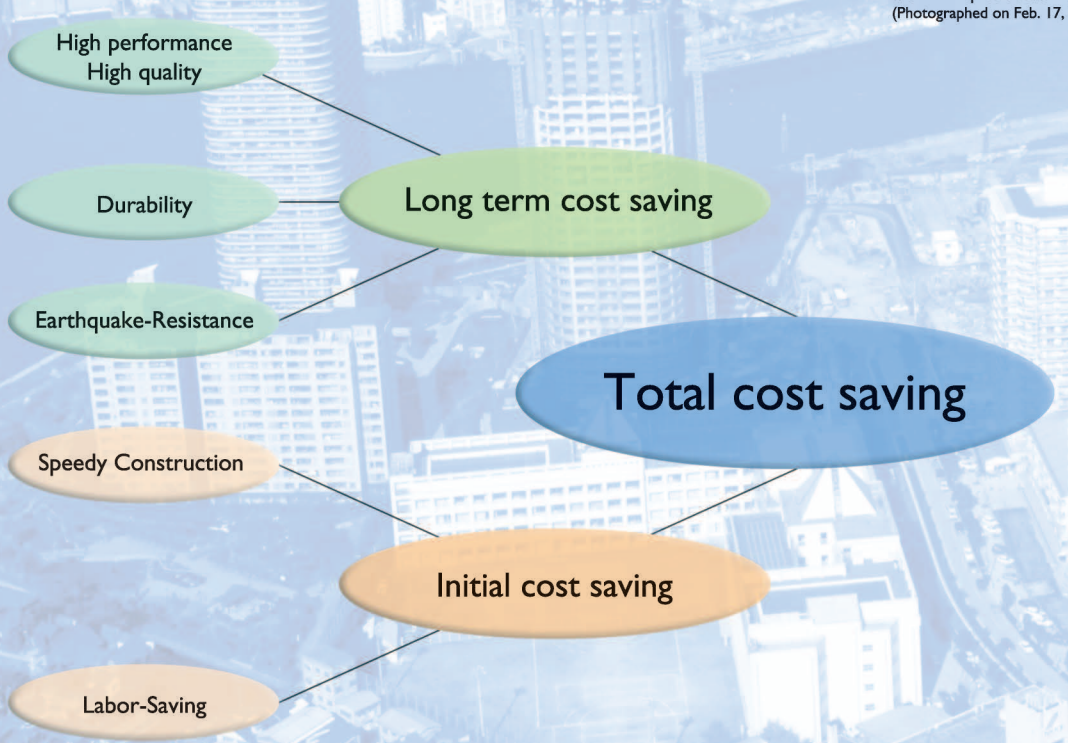
All buildings with NMB Splice Sleeve withstood the Kobe-Osaka 7.9 Richter scale earthquake in 1995 without any structural damage.

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

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)

NMB Splice Sleeve System contributes to the industry in :



NMB SPLICE SLEEVE SYSTEM CREATING

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.

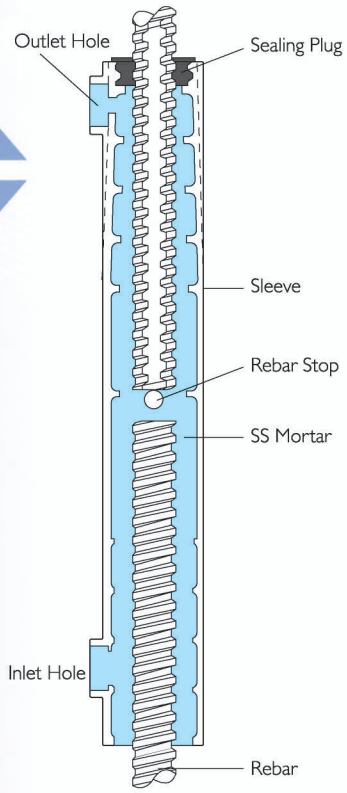
The interior of the sleeve is then filled with SS Mortar grout.

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

BUILDING APPLICATION

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.

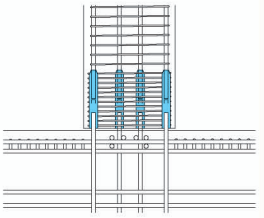
Connecting Columns, Beams, Walls and other essential structural components for Super High-Rise Office Building / Apartment House, Hotel, School, Shopping Mall, Theater, Parking Garage, Stadium and Airport Control Tower.

Column/Beam

Precast

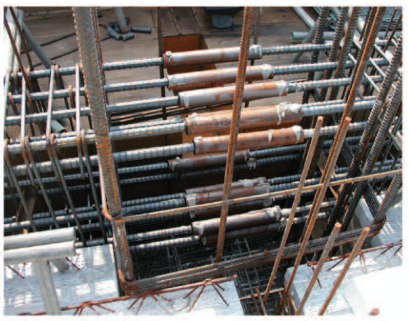
Slim Sleeve for connecting Precast beams

Super UX, NX II Sleeve for Precast column



Cast in place

Slim Sleeve for connecting rebar cage



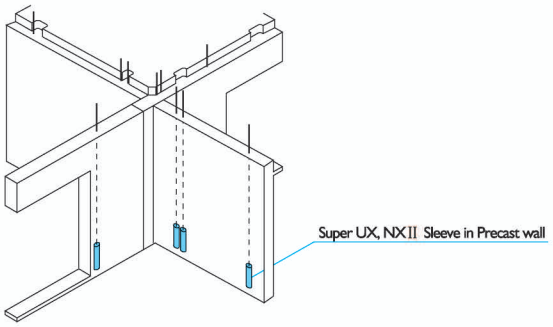
Slim Sleeve for connecting beam rebar

Wall

Precast

High-Rise apartment

Precast concrete wall



CIVIL ENGINEERING APPLICATION

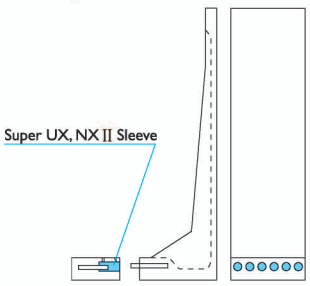
Used in Sound Barrier Walls, Box Culverts, Retaining Walls, Bridges, Caissons and a growing number of other civil engineering projects.

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

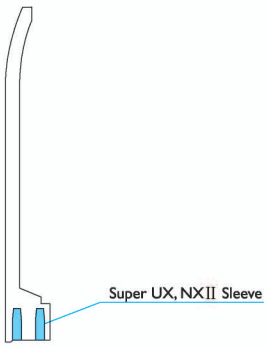
Bridge Pier, Sound Barrier Wall, Retaining Wall, Caisson, Concrete Box Culvert, Concrete Barge.

Sound Barrier and Retaining Wall /Precast

Retaining Wall

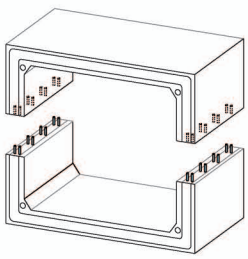


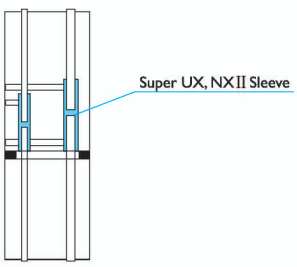
Sound Barrier Wall



Box Culvert /Precast

Box Culvert



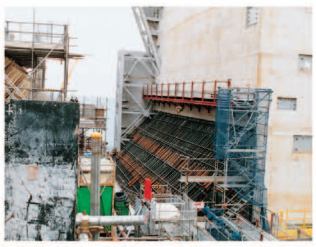


Reinforcement/Cast-in-place

Bridge Pier Reinforcement

Bridge/Cast-in-place

Akashi Channel Bridge



Akashi Channel Bridge, Anchorage

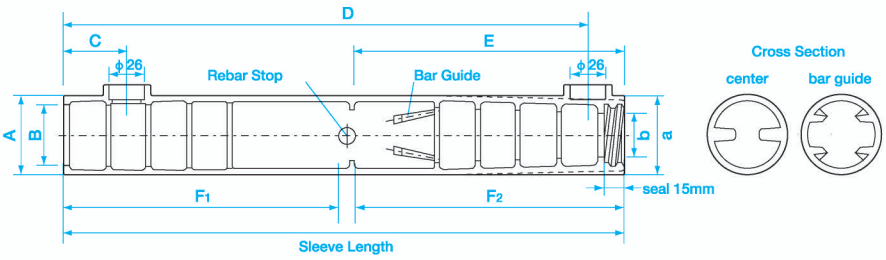
Bridge Pier

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 No shrinkage or elongation of sleeves
NX II Sleeve	A Class	D16～D22 SD295A·B～SD390	

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/15 kg bag)
			O.D. (A,a) (mm)	I. D.							
				Wide End (B)	Narrow End (b)				Wide End (F_1)	Narrow End (F_2)	
5-NX II	D16 *(D12,D10)	220	44	32	22	47	193	105	80～110	95～105	35
6-NX II	D20 *(D16,D12)	250	48	36	25		223	120	95～125	110～120	27
8UX (SA)	D25 *(D20,D16)	370	58	44	31		343	175	150～185	165～175	13
9UX (SA)	D28 *(D25,D20)	415	63	48	35		388	200	175～205	190～200	10
10UX (SA)	D32 *(D28,D25)	455	66	51	39		428	220	195～225	210～220	9
13/14UX (SA)	D40 *(D40,D32)	620	82	62	51		593	300	275～310	290～300	4

* ( ) indicates transition splice

Connections between different sizes of reinforcement are called "transition splices". Use a sleeve size corresponding to the larger size rebar.

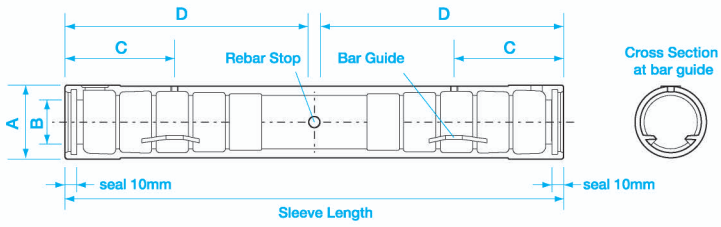
Example: Connection of rebars sizes D28 and D32

Use: 10UX(SA)

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

NMB 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	D16 ~ D51 SD295A·B~SD490	Easy to connect No shrinkage or elongation of sleeves

Sleeve	Rebar Size	Sleeve Length (mm)	Sleeve Diameter (mm) O.D. (mm) A	Sleeve Diameter (mm) I.D. (mm) B	Set Screw Position (mm) C	Rebar Stop (mm) D	Rebar Embedment (mm)	Grout Approx. Consumption (pcs / 15kg bag)
S5U	D16 (D10-D13)	240	37	22	54	115	105 --- 120	53
S6U	D19 (D13-D16)	270	40	25	54	130	120 --- 135	42
S7U	D22 (D16-D19)	300	44	28	73	145	135 --- 150	34
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 (D38-D41)	710	92	62	150	350	340 --- 355	5

*( )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 is 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.

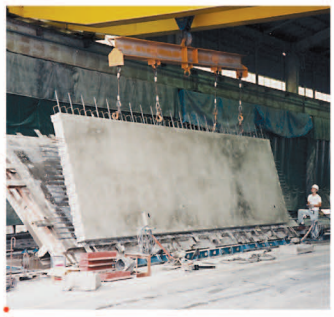
The NMB Splice Sleeve System is specially designed to facilitate construction at job site and greatly reduces construction period.

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.

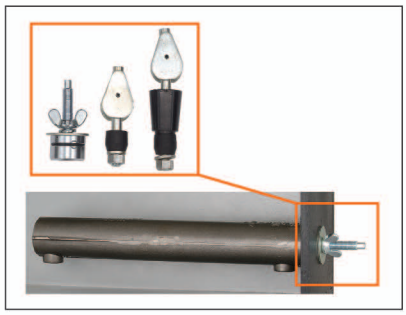
Super UX / NX II Sleeve

Assembling Precast Wall and Beam

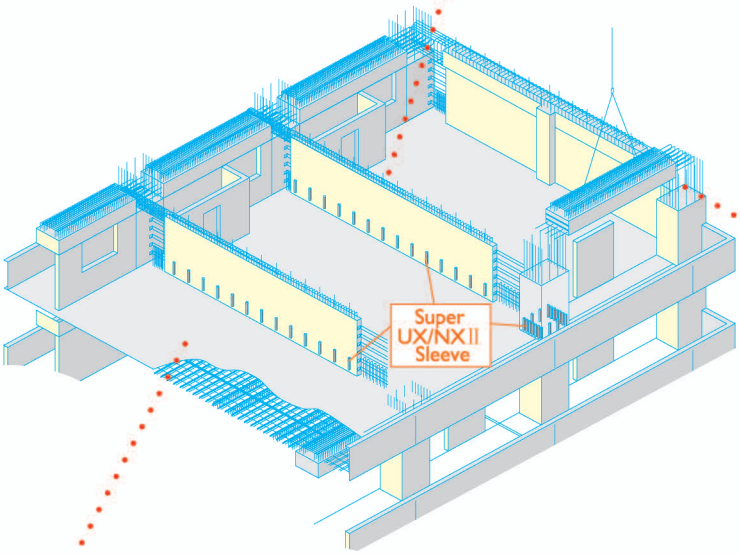
Precast wall before pouring concrete



Precast wall member

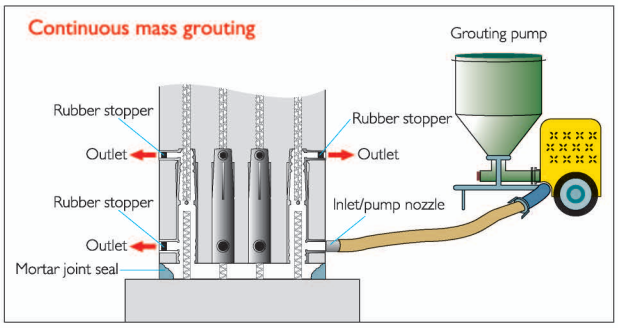


Sleeve Setter



Assembling rebar cage for precast column

Erecting precast column



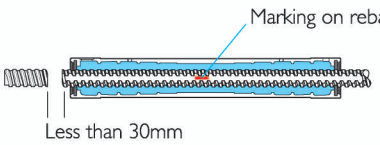
NMB SLIM-SLEEVE®

Assembling Precast Beam

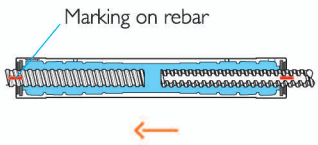
Sliding Slim Sleeve onto rebar

Sliding back to the center

Placing stirrup



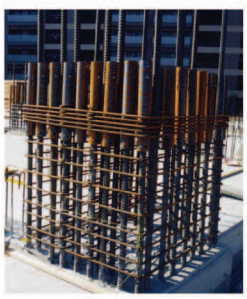
Sliding Slim Sleeve to one side



Sliding back to the center

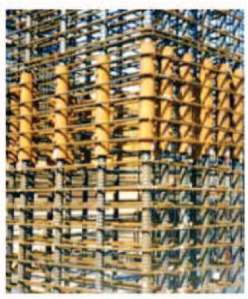
Injecting SS Mortar

Assembling Rebar Cage for Column



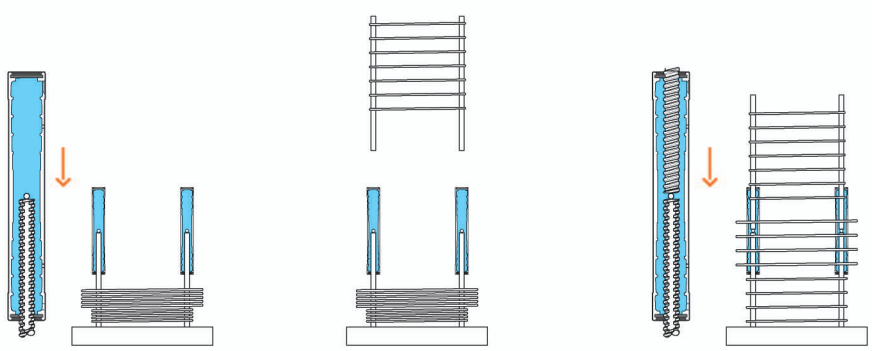
Placing Slim Sleeve onto rebar

Lowering upper rebar cage



Placing hoop

Injecting SS Mortar

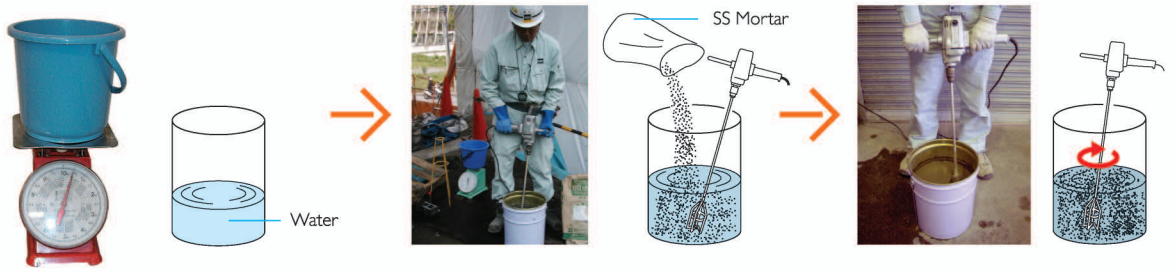


SS MORTAR

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:

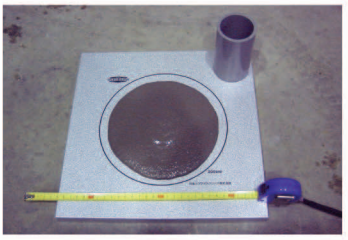
- High Early Strength ..... Approximately 30 N/mm² in 24 hours
- High Ultimate Strength .....Approximately 100 N/mm² in 28 days
- Flowability
- Non-shrink
- Pre-Mixed Formulation

2) Mixing

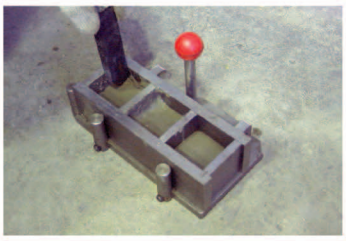
SS Mortar is delivered in **15** kg bag in a ready-to-use formulation, requiring only the proper amount of water and time to assure a uniform mix of stable quality and specified performance.

Test

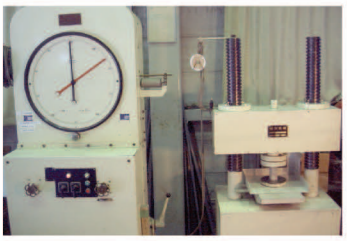
Compressive Strength Test



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 **15** kg	**2.1 - 2.3** Litre	
Mixing time	Approximately 2 minutes	
Consistency (Flow Guide Table)	155-235mm diameter	
Ambient temperature	0℃ - 60℃	
Pot Life	Approximately 40 minutes after mixing	
Minimum Compressive strength (28 days by cubic mold)	70 N/mm²	70 N/mm²

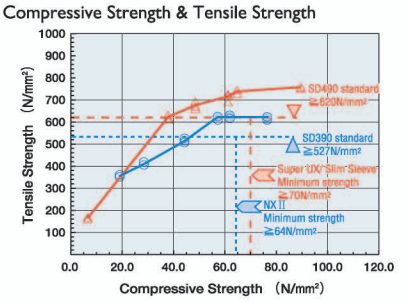
Example of the test result for fresh SS Mortar

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

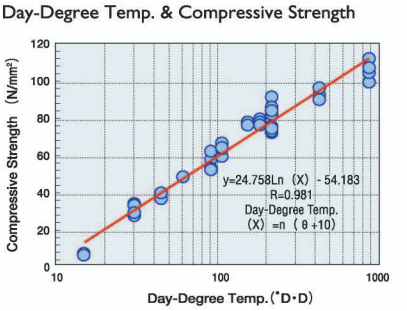
Example of the test result for hardened SS Mortar

Consistency (Flow table)	Curing temp	Compressive Strength (N/mm²)					
		12 hours	18 hours	1day	3 day	7 day	28 day
180 mm	5℃	—	4.0	10.1	42.2	56.5	86.3
	20℃	5.6	20.2	30.5	55.2	71.1	100
	30℃	18.5	36.0	49.0	68.5	79.1	101

Compressive Strength & Tensile Strength



Day-Degree Temp. & Compressive Strength

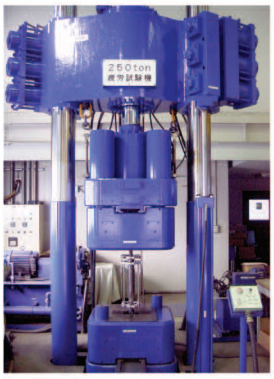


TECHNICAL DATA

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

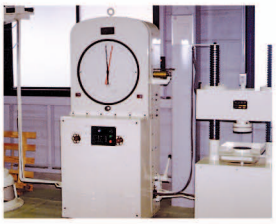
Tests for strength, rigidity, ductility and other performance characteristics are carried out using advanced test equipments at Nissco Technical Center (NTC).

Testing equipments at Nissco Technical Center

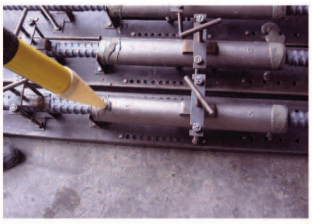


250 ton Fatigue testing machine

Setting time test



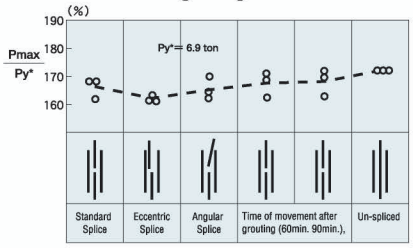
Hydraulic compression testing machine



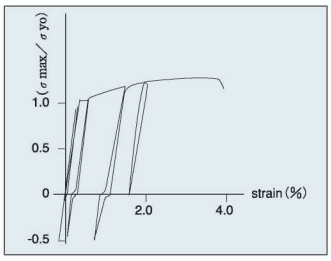
Assembling test specimens in the temperature controlled curing room

Technical Data

Effect of misalignment of bars and disturbance after grouting

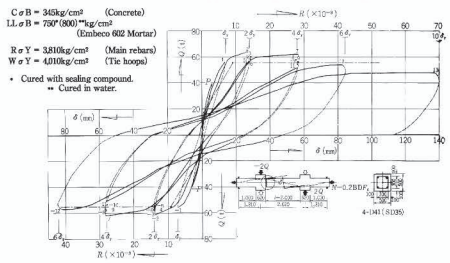


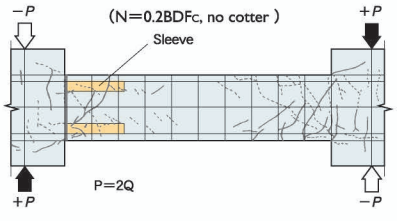
Elastic and plastic cyclic test (SD490 D41)



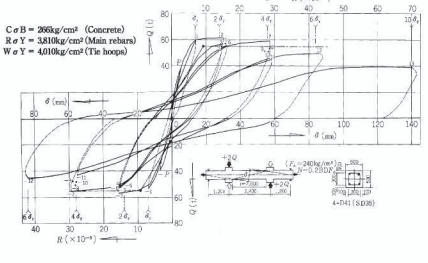
Structural tests on full size column and beam

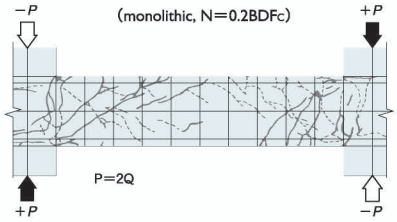
Q-δ Curve (N= 0.2BDFC, spiral hoop) with NMB Splice Sleeve





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

Fc= 60 N/mm²
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/mm² (minimum stress, min.=1.97kgf/mm²), 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 ℃ 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 ℃ was observed.

The NMB Splice Sleeve System is used worldwide

Esperaldas 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

NISSCO **SPLICE SLEEVE GROUP**

ISO 9001 BUREAU VERITAS Certification

http://www.splice.co.jp

Rev.5.

SINGAPORE GREEN BUILDING PRODUCT SGBC

VERY GOOD SGBP 5114

SPLICE SLEEVE JAPAN, LTD. Corporate Office
17-1 Nihonbashi, Hakozaki-cho, Chuo-ku, Tokyo,
103-0015 Japan
Phone: +81-3-5642-6120 Fax: +81-3-5642-6150

SPLICE SLEEVE JAPAN, LTD.
Nissco Technical Center (NTC)
313-5 Mukaimachi Minamihanashima, Matsudo-shi,
Prefecture of Chiba, 271-0065, Japan
Tel: 81-4-7308-3681 Fax: 81-4-7308-3682

SPLICE SLEEVE JAPAN, LTD. Osaka Branch
4-7-7 Hiranomachi, Chuo-ku,
Osaka, 541-0046 Japan
Phone: +81-6-6222-1321 Fax: +81-6-6222-1330

SPLICE SLEEVE NORTH AMERICA, INC.
38777 West Six Mile Road, Suite 205
Livonia, MI 48152 U.S.A.
Phone: +1-734-838-0420 Fax: +1-734-838-0422

SPLICE SLEEVE(S) PTE LTD.
601 Sims Drive #01-06 Pan-I Complex
Singapore 387382
Phone: +65-6738-3655 Fax: +65-6738-5019
https://www.splicesleeve.sg

Scan to access softcopy brochure