

LOK-TEST & CAPO-TEST for in-situ strength

Section 3

Hardware

Testing Procedures

Instruments

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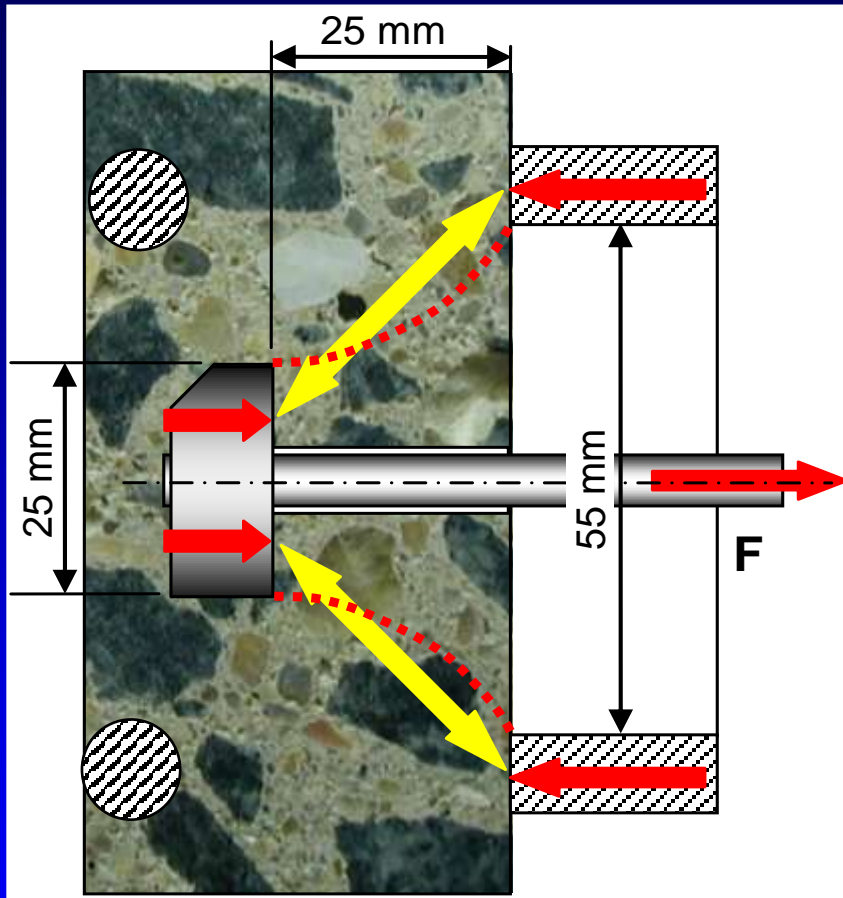
GERMANN INSTRUMENTS A/S

September 2023

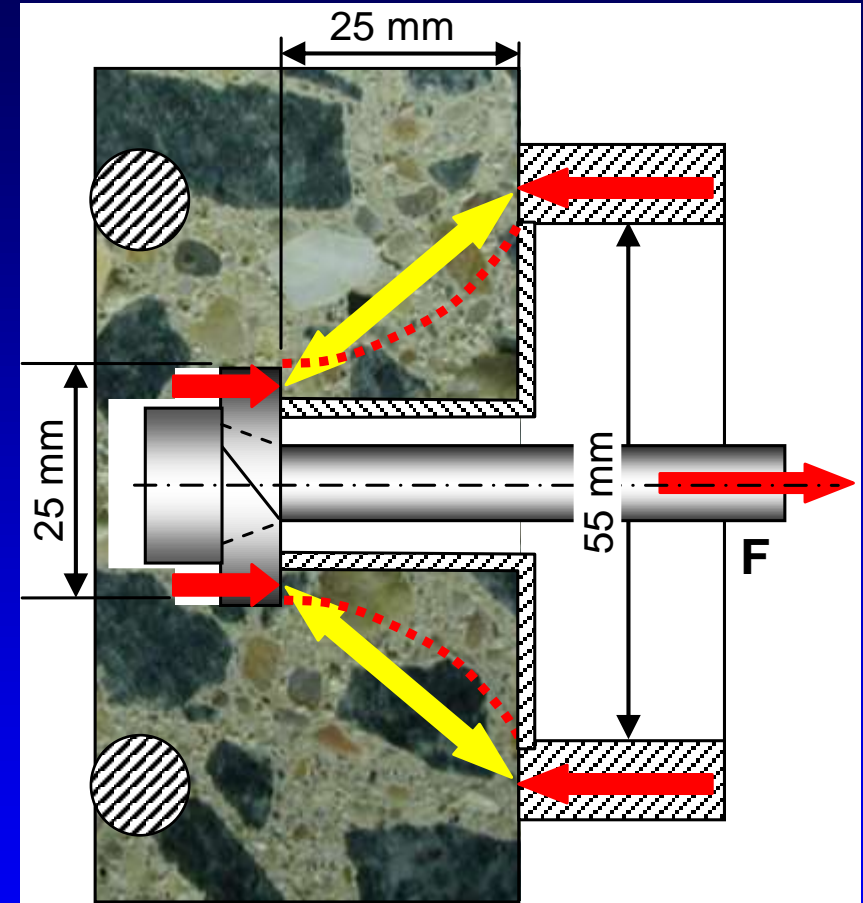
In-Situ Strength, why?

- Control of effects of transportation and compaction
- Effects of curing, quality of the cover layer protecting the reinforcement against chloride ingress
- Eliminate shortcomings of cylinders and cubes
- Low strength of laboratory specimens
- Changed mixes, intentionally / not intentional
- Strength of existing structures for load carrying capacity calculations
- Timing of safe and early loading operations

The two in place test systems presented



LOK-TEST



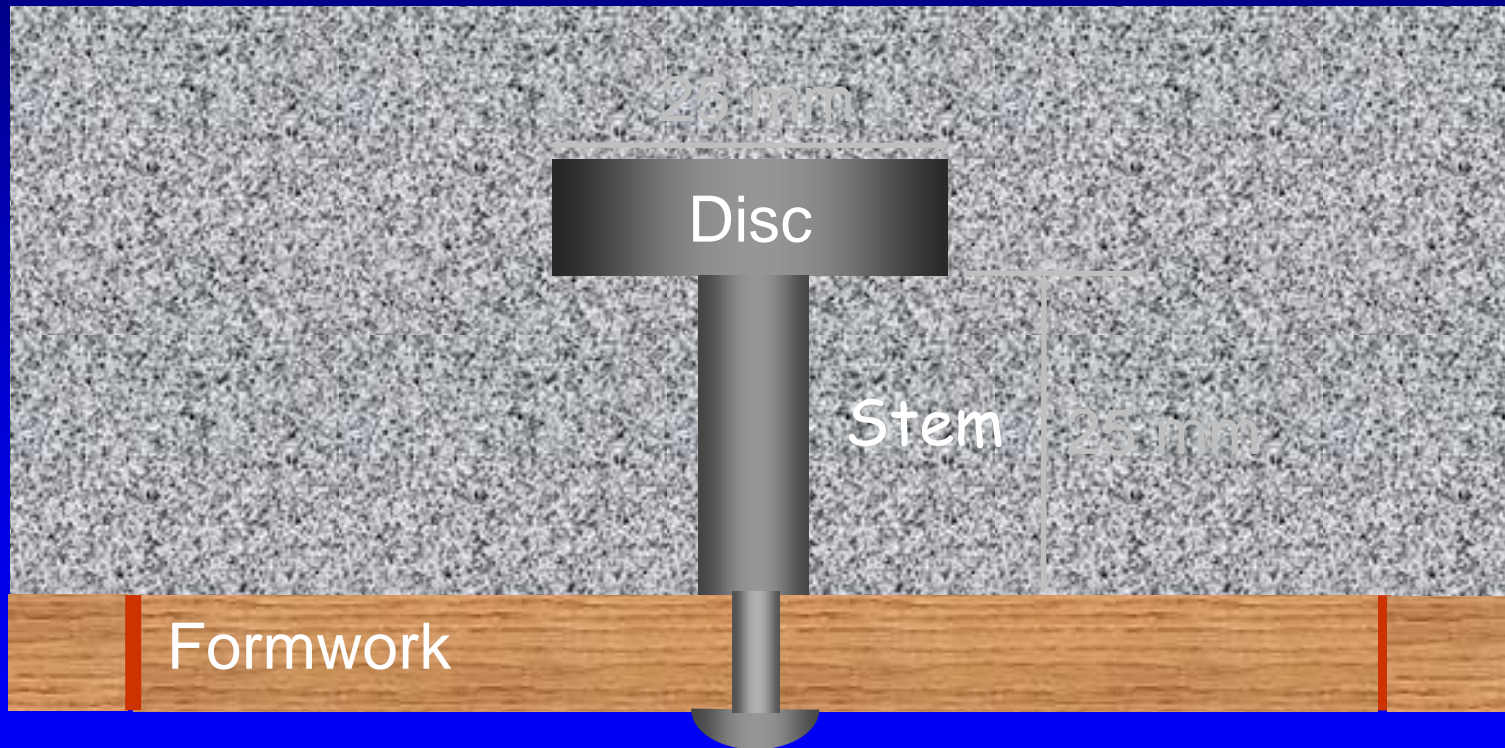
CAPO-TEST

LOK-TEST

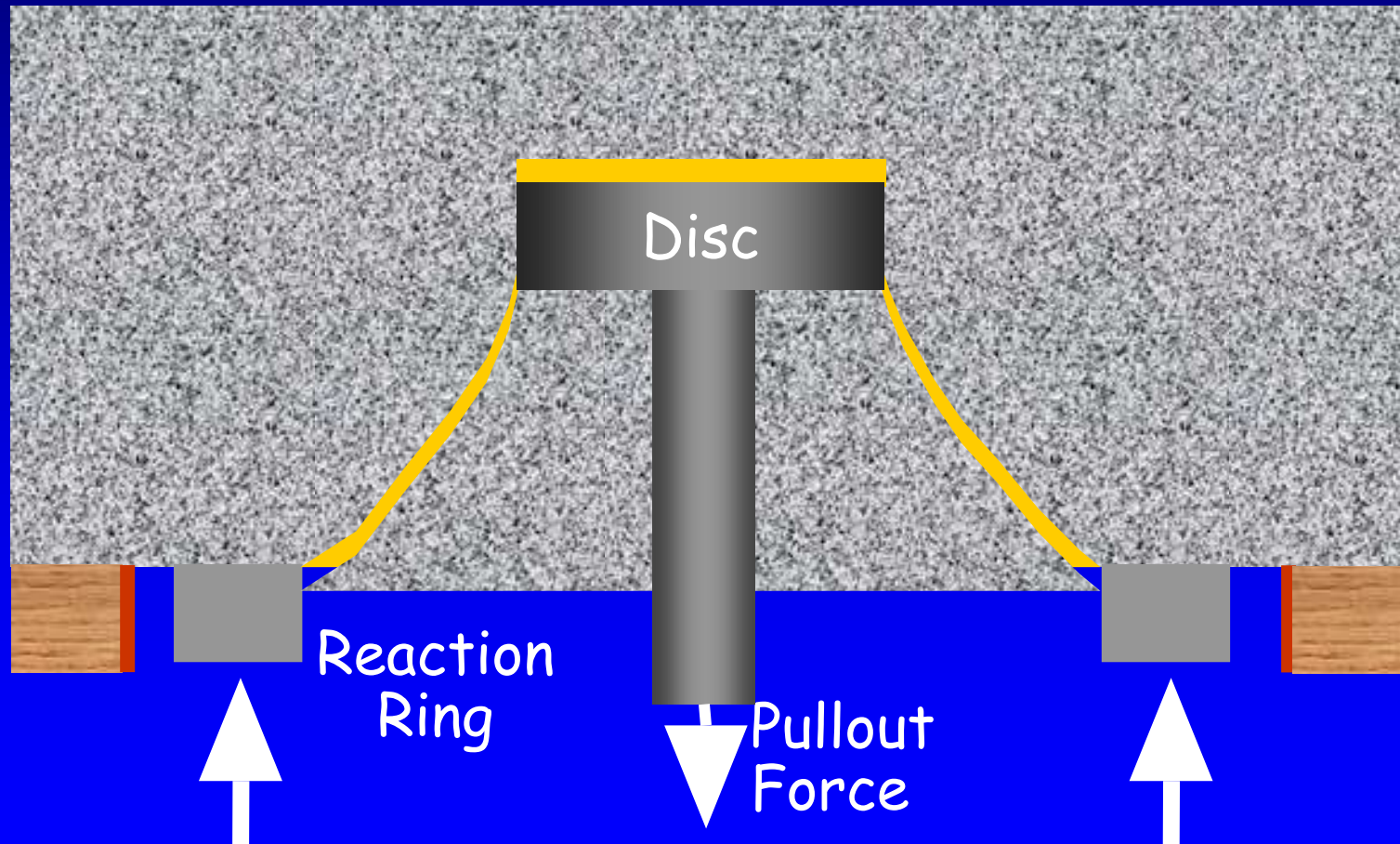
LOK-TEST for new structures

- Install inserts
- Ready the testing
- Perform the LOK-TEST either to a required strength or to top-peak loading, with or without pull-out
- Transform the kN pullforce to compressive strength of lab cubes (or cores) or lab cylinders by general correlation

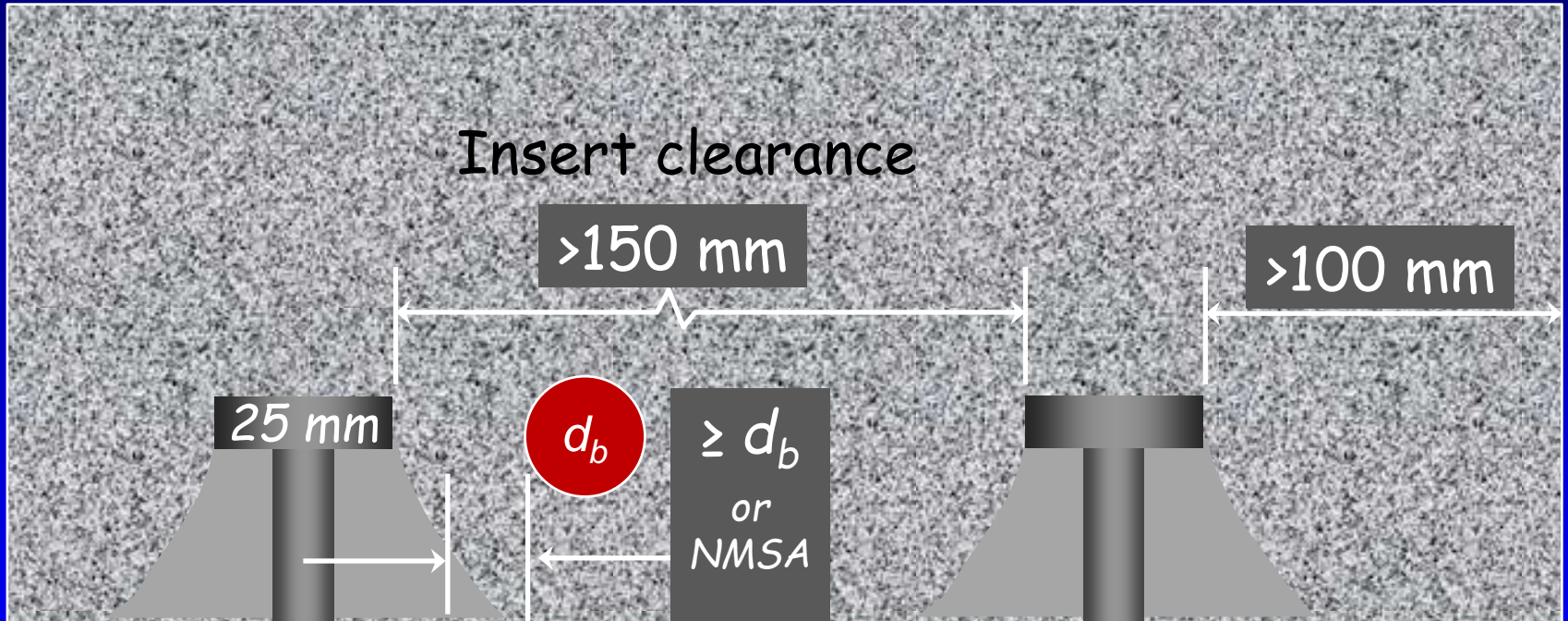
LOK-TEST



LOK-TEST



Clearance Requirements ASTM C900



Reinforcement
clearance

Edge
distance

LOK-TEST Inserts, <60 MPa cyl, strength

L-40



Nailed to
formwork

L-42

Attached to
formwork cutouts



Or through a
7 mm hole in the form

L-45



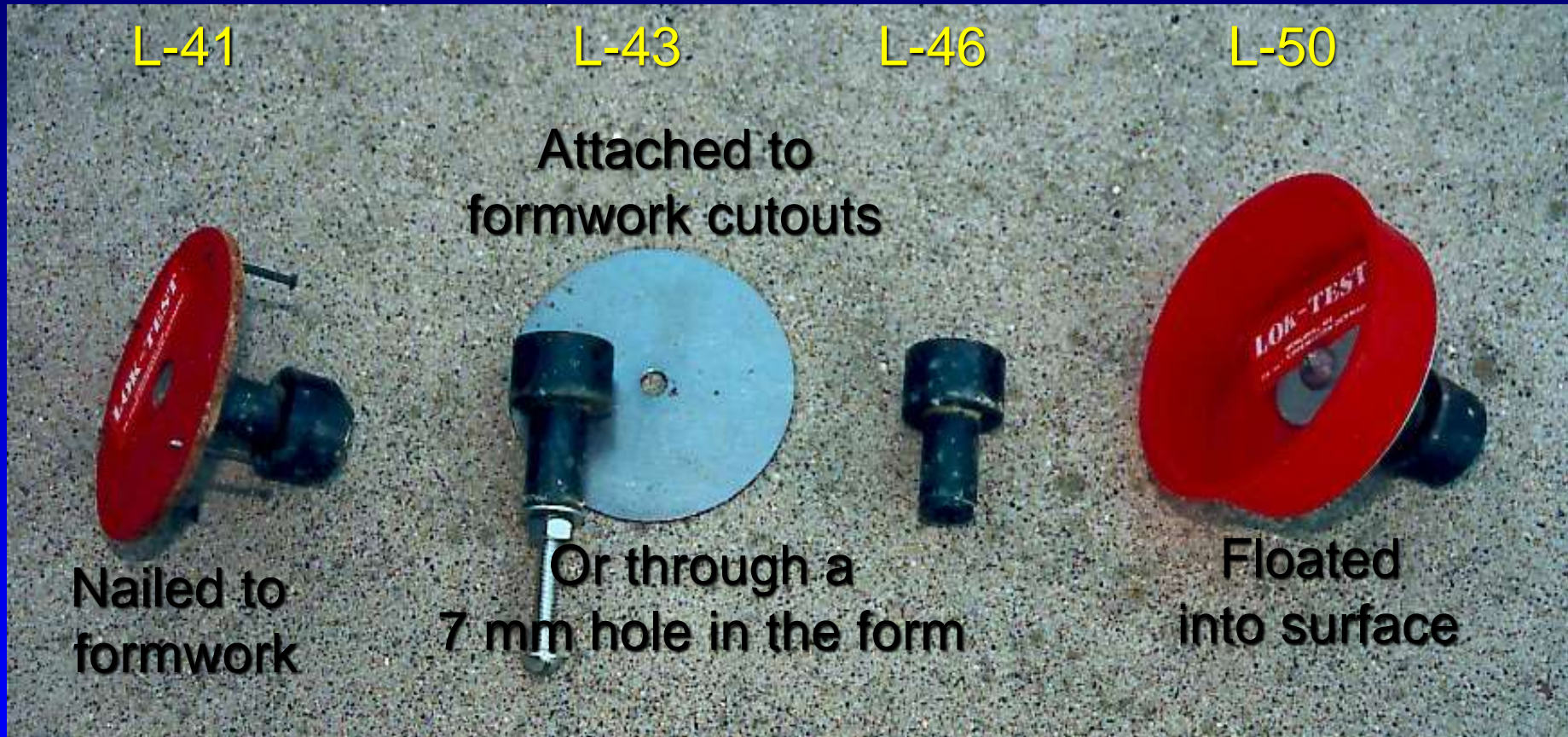
L-49



Floated
into surface

Max pullforce 55 kN, equiv. to 60 MPa cylinder strength or 80 MPa cube strength

LOK-TEST inserts >60 MPa cyl. strength



Max pullforce 90 kN, equiv. to 105 MPa cylinder strength or 140 MPa cube strength
 Note: Both sets of inserts <60 MPa and >60 MPa follow the general correlations(s)

LOK-TEST Inserts

L-42



Nailed to
formwork

L-44

Attached to
formwork cutouts



Or through a
7 mm hole in the form

L-45



L-49



Floated
into surface

L-40 insert for nailing to wooden formwork



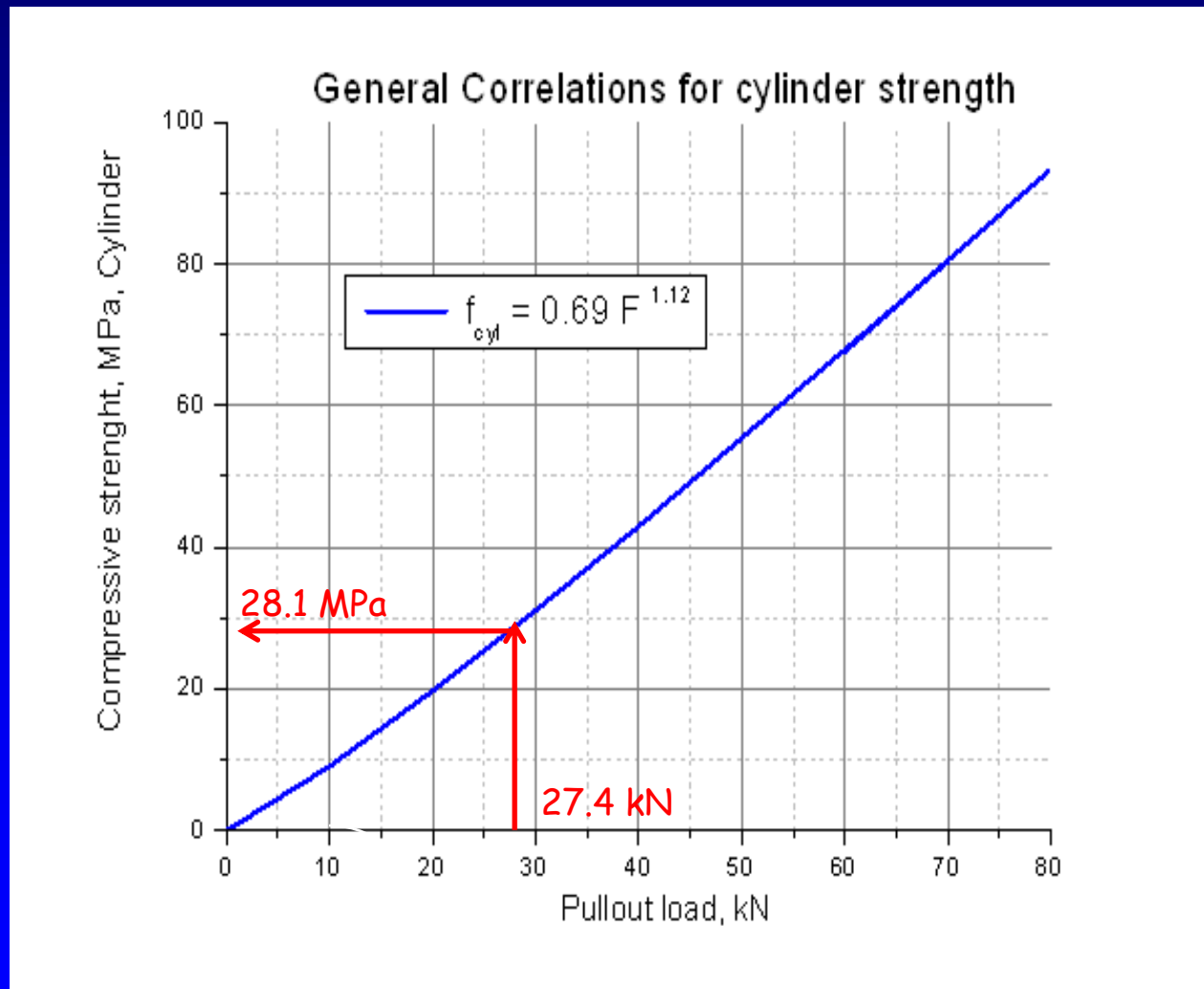
LOK-TEST'ing



"H" is the peak-load, saved in the memory with time and date of testing for documentation

Duration of one tests including preparation is 3-5 minutes

Correlating the kN to MPa using the general cylinder correlation



L-42 Insert for safe and early formstripping

L-40



Nailed to formwork

L-42



Attached to formwork cutouts

Or through a 7 mm hole in the form

L-45



L-49



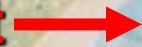
Floated into surface

Cut hole in formwork

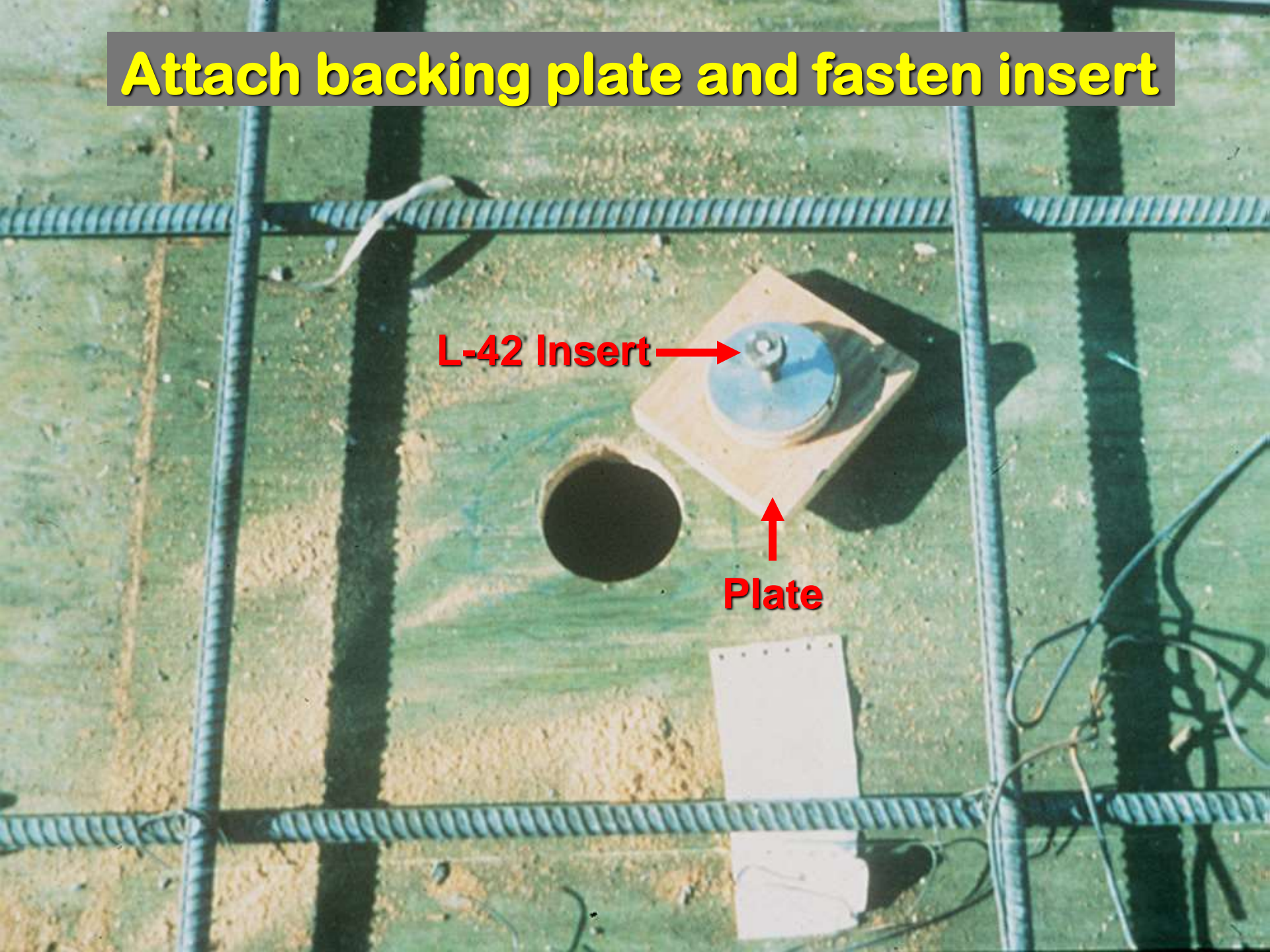


Attach backing plate and fasten insert

L-42 Insert



Plate





Sealant

- **Attach insert support assembly to form**
- **Apply sealant**
- **Place concrete**

Strength for Formwork Removal



Vice-President Mr. Sal Fasullo, C.E.T.,
Davroc & Associates Ltd., Canada

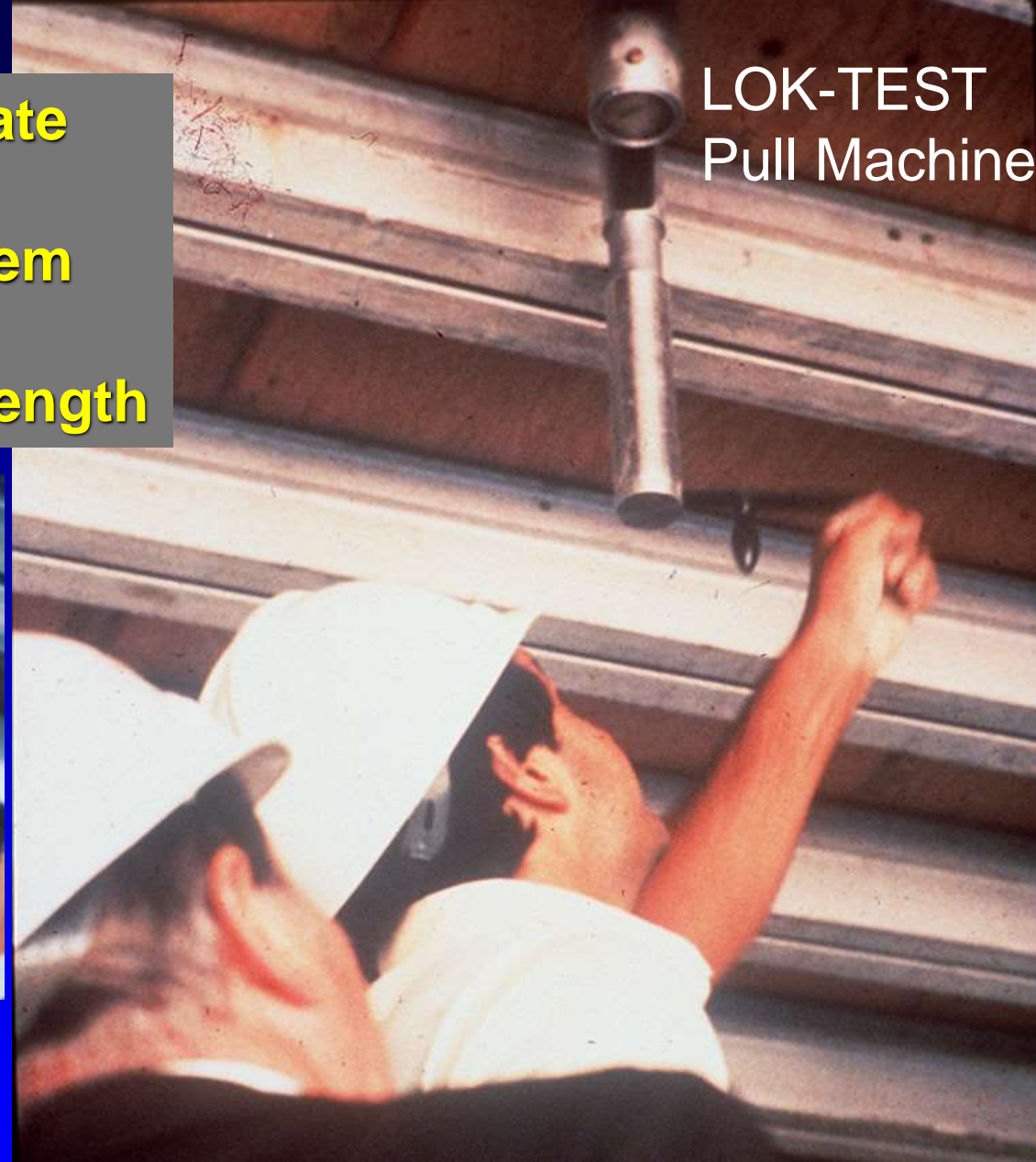
Mr. Sal Fasullo has during the years been in charge of and responsible for testing of +200,000 LOK-TEST's

Build right



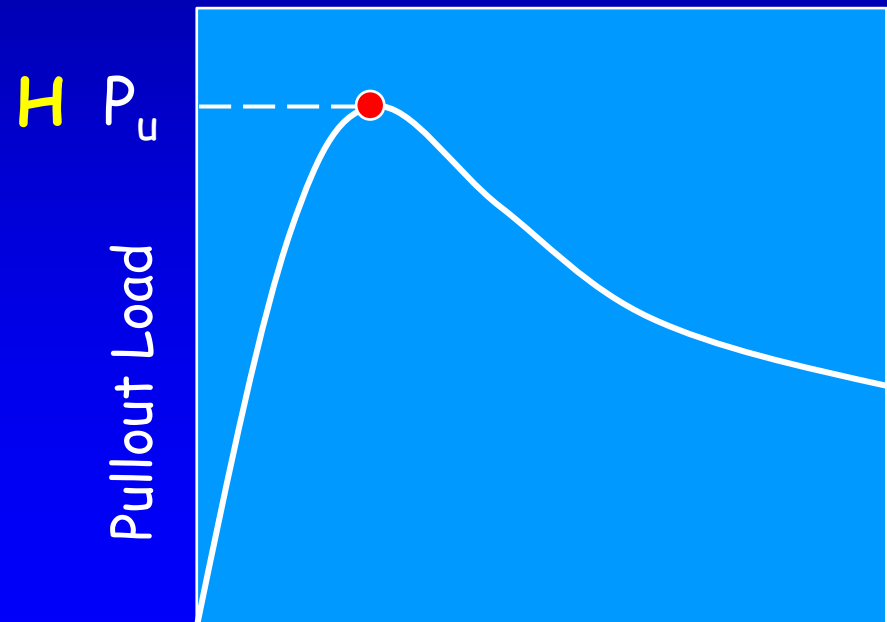
- Remove backing plate
- timed by maturity
- Attach loading system
- Apply load
- Measure pullout strength

LOK-TEST
Pull Machine



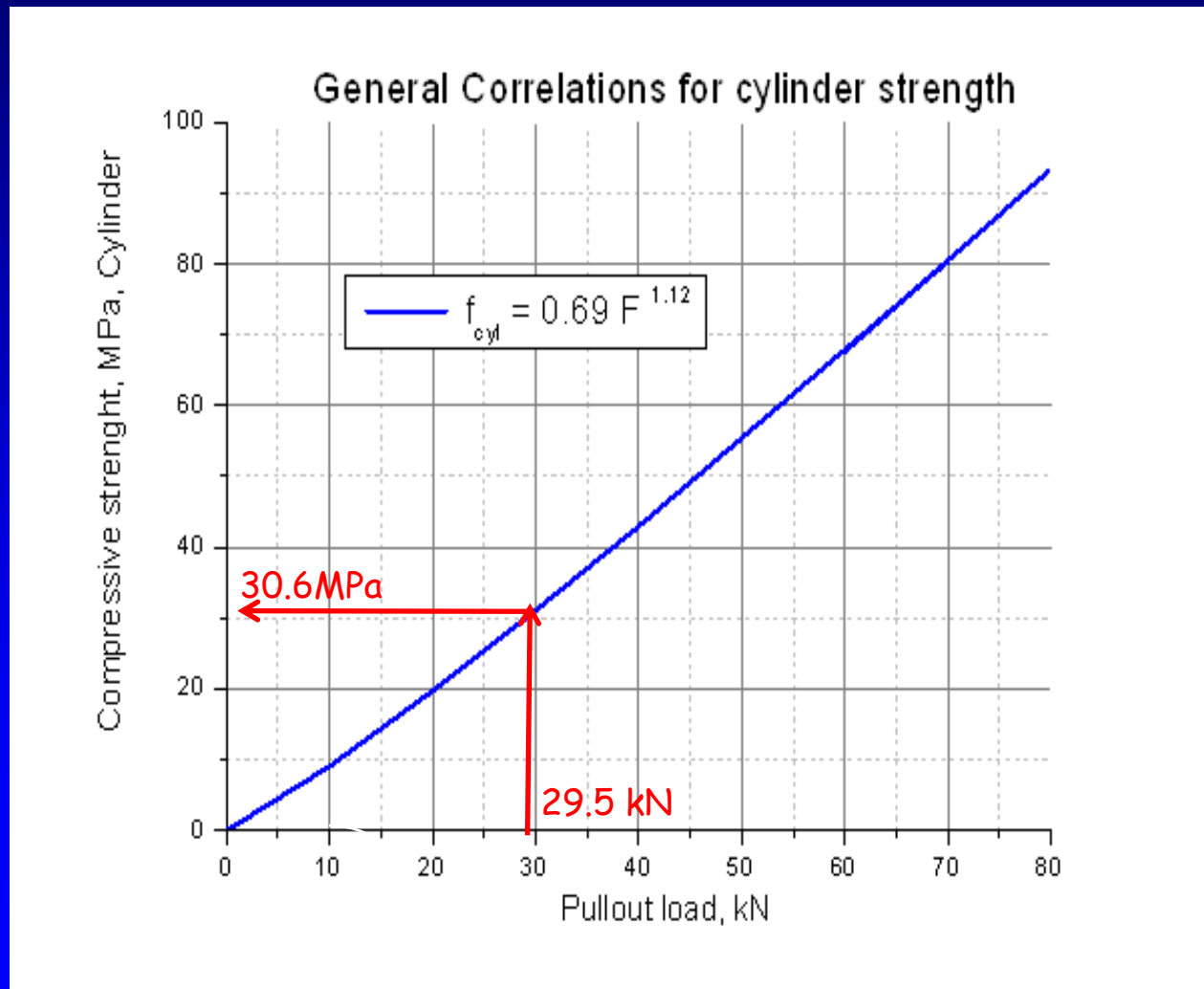
Peak Load, example $H = 29.5$ kN

- At peak load, ≈ 0.2 mm surface displacement
- Gradual decrease in load with continued displacement



Surface Displacement

Correlating the kN to MPa using the general cylinder correlation



Floating Inserts

L-40



Nailed to
formwork

L-42

Attached to
formwork cutouts



Or through a
7 mm hole in the form

L-45



L-49



Floated
into surface

Placement of L-49 inserts



Testing of L-49 inserts floated in the top surface for QC



COMA-Meter
for maturity

Testing of L-49 inserts floated in the top surface, tunnel slab



Outcome: The mix delivered and placed had the double strength of the mix ordered by the contractor (much too expensive)

Deeper testing than at the surface 25 mm



Deeper embedment of the LOK-TEST insert can be made using e.g. the L-49 insert as illustrated adjacent.

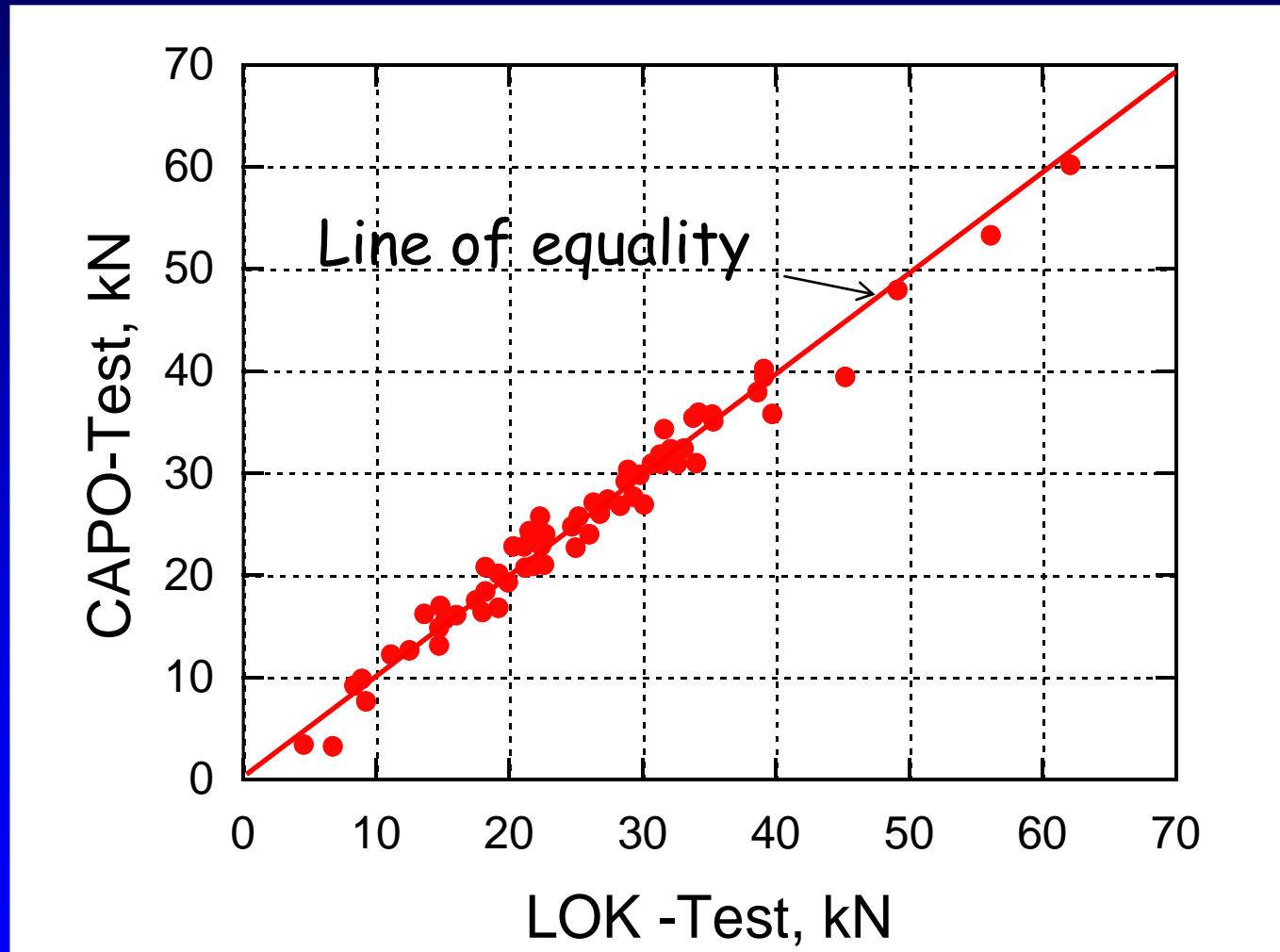
Using this insert the testing surface will be lowered 20 mm from the surface.

CAPO-TEST

Cut And PullOut Test

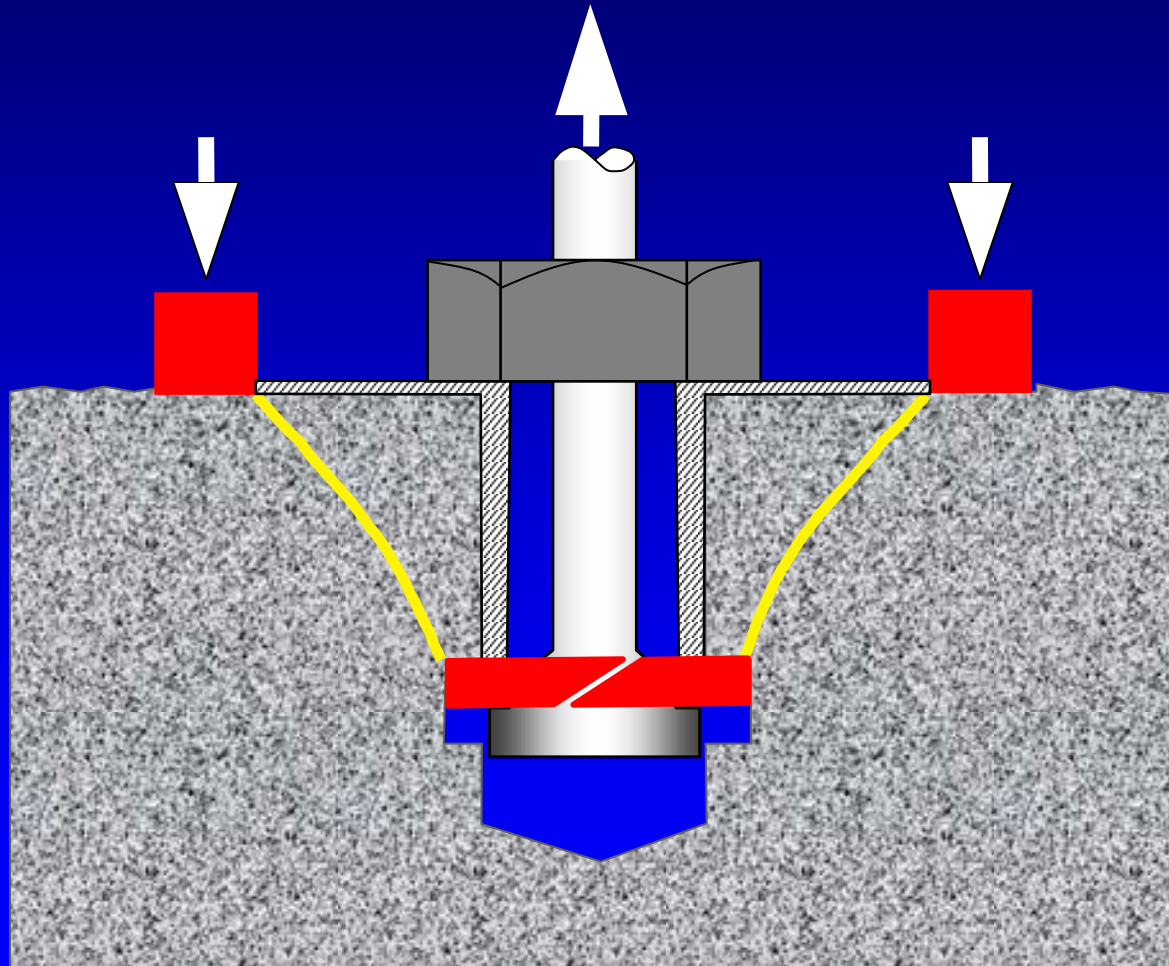
Instruction video on Google
"CAPO-TEST ASTM-C900"

LOK-TEST to CAPO-TEST



Refs: Krenchel (1982), Bellander (1983), Yun (1990), & Meyer (1994)

CAPO Test



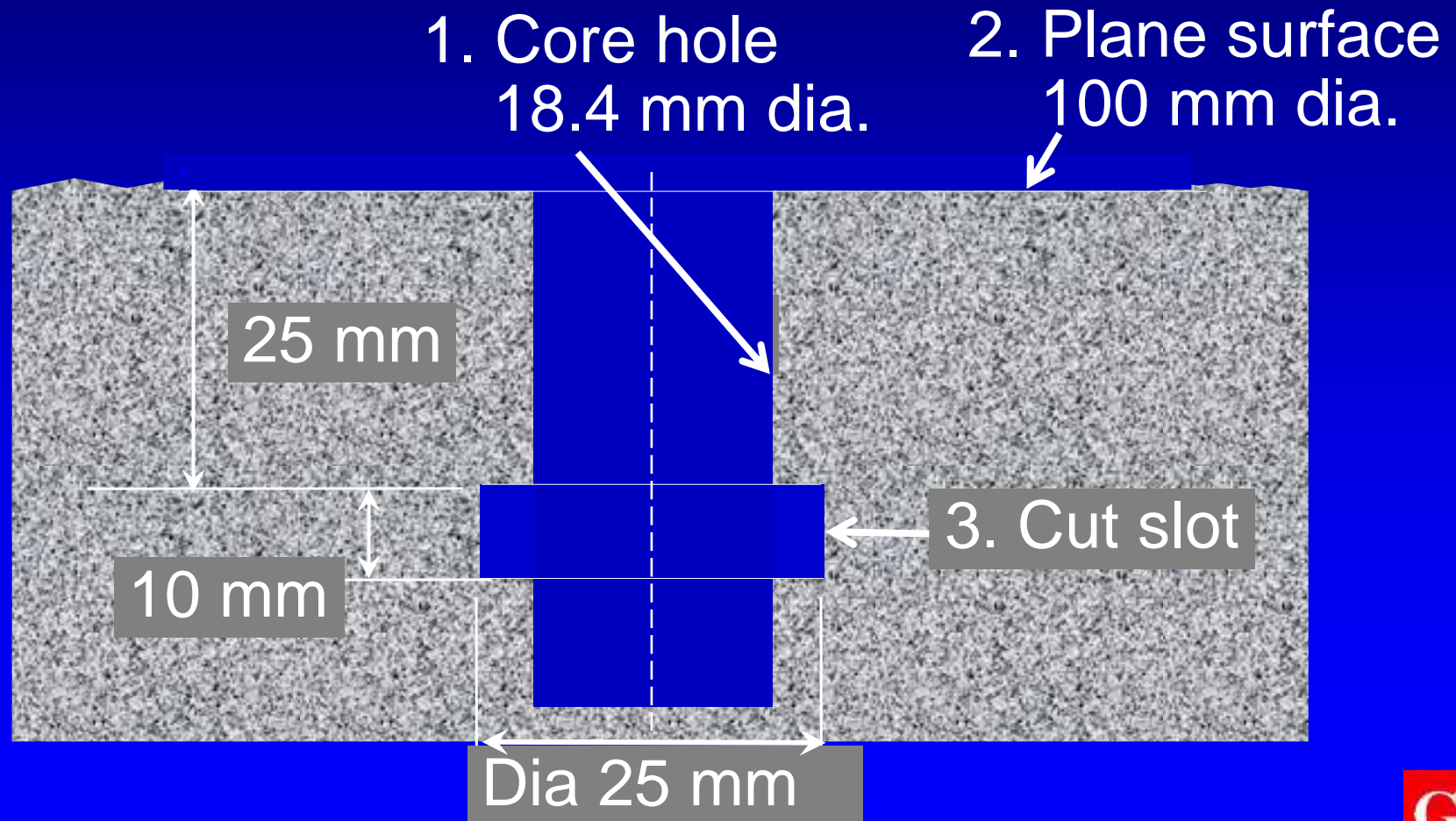
CAPO-TEST Failure



"Leaves" from the 2nd crack pattern with the concrete in compression **STRUT** being intersected in the softening regime

CAPO-TEST Procedure

Prepare Concrete



Core Hole



Shown here using the vacuum plate, otherwise perform the coring handheld, stepping on the flange

Test



Plane surface



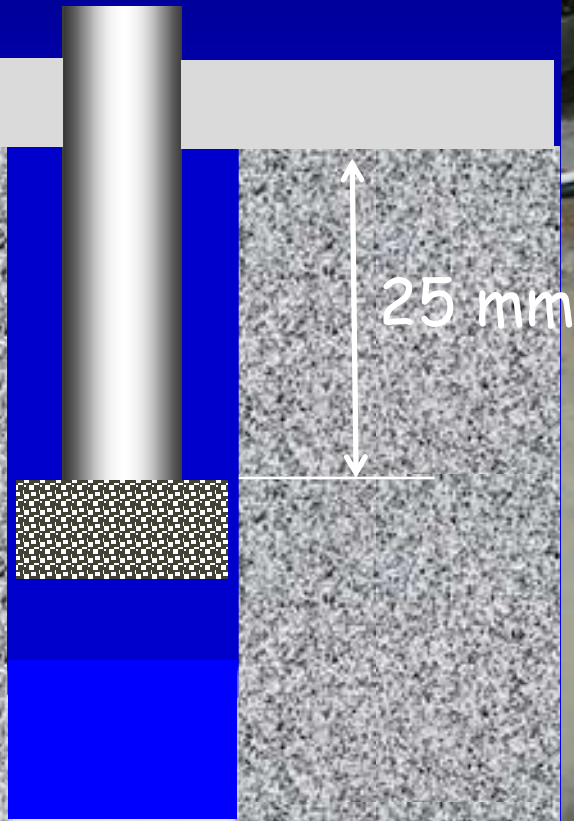
Use governing tap
for centering if
performed handheld



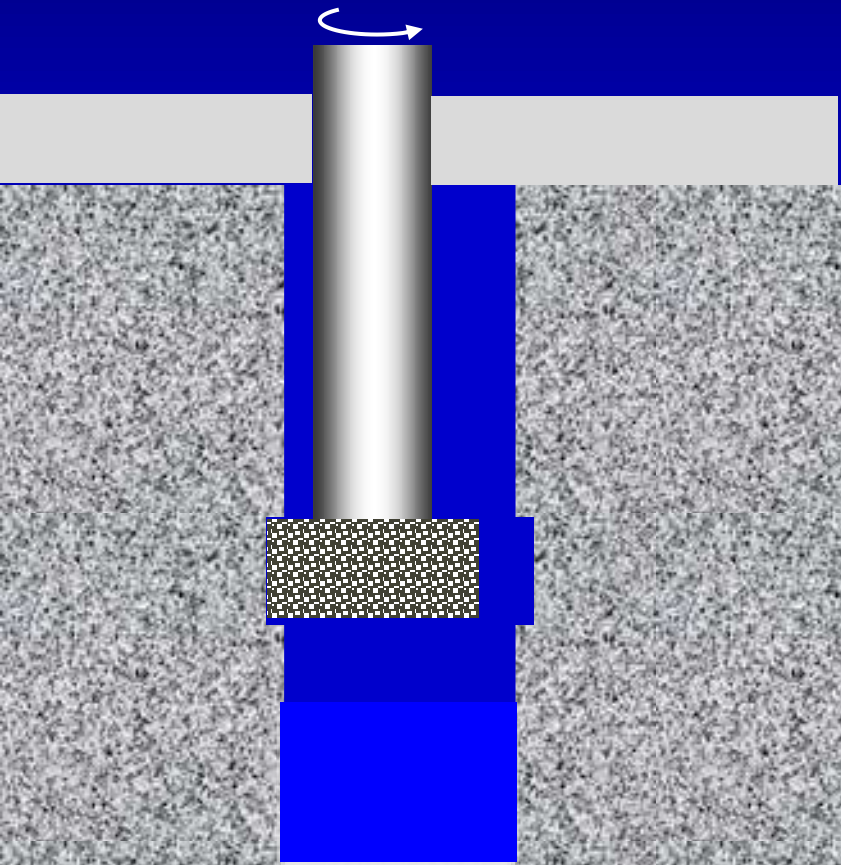
Planed surface



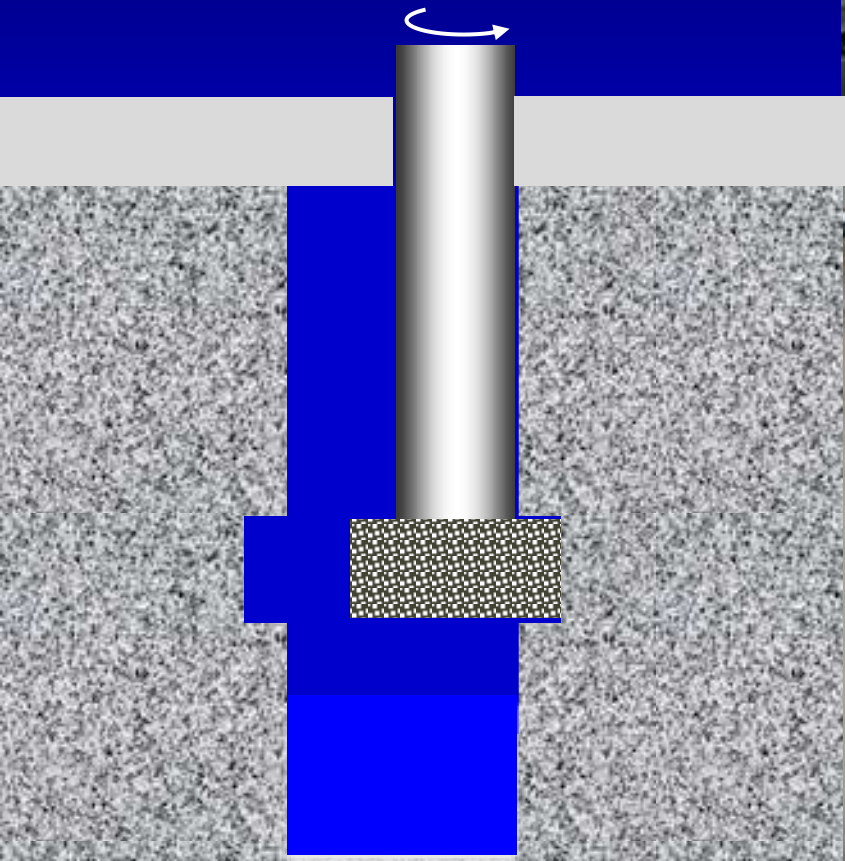
Cut Slot



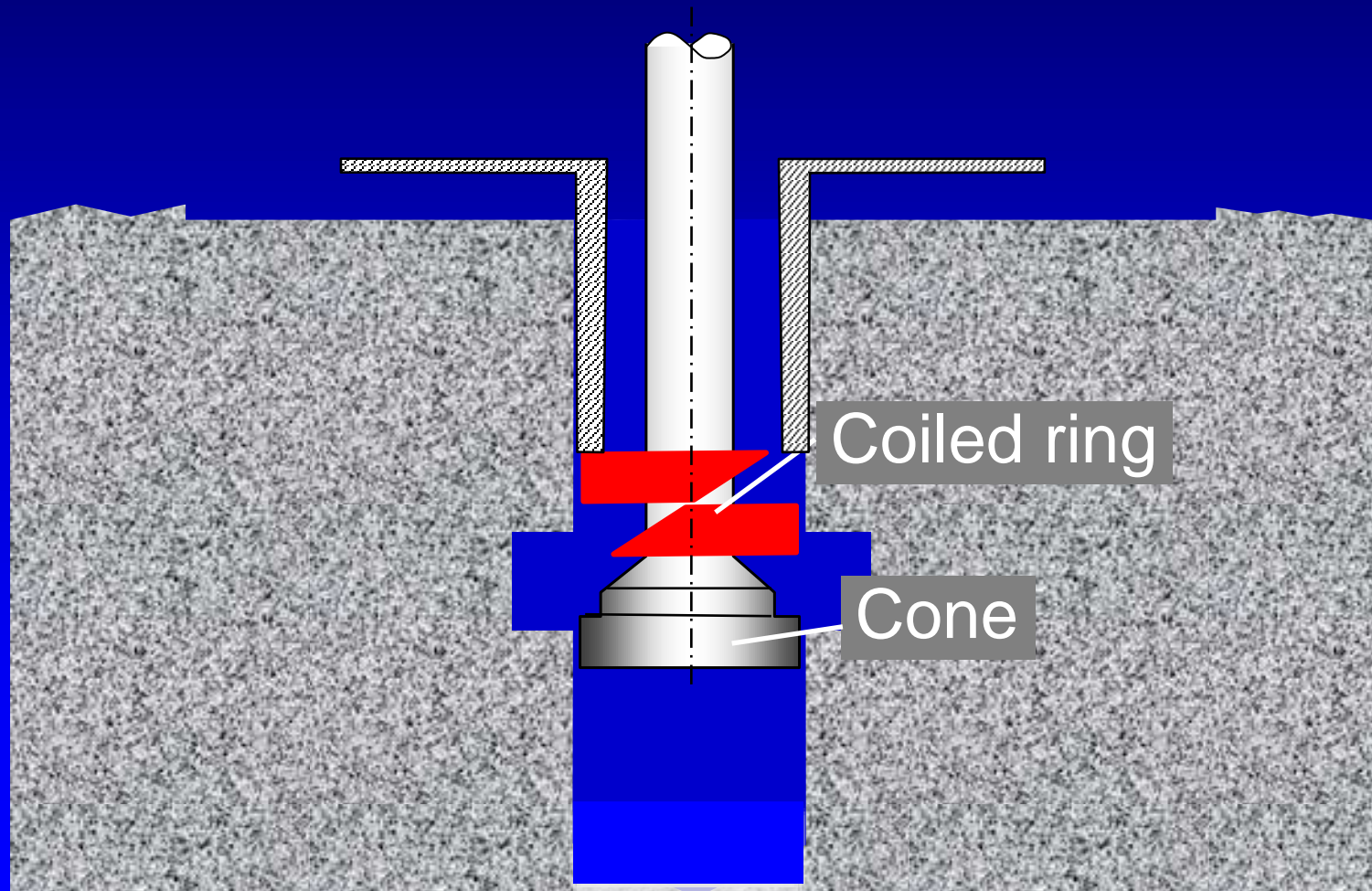
Cut Slot



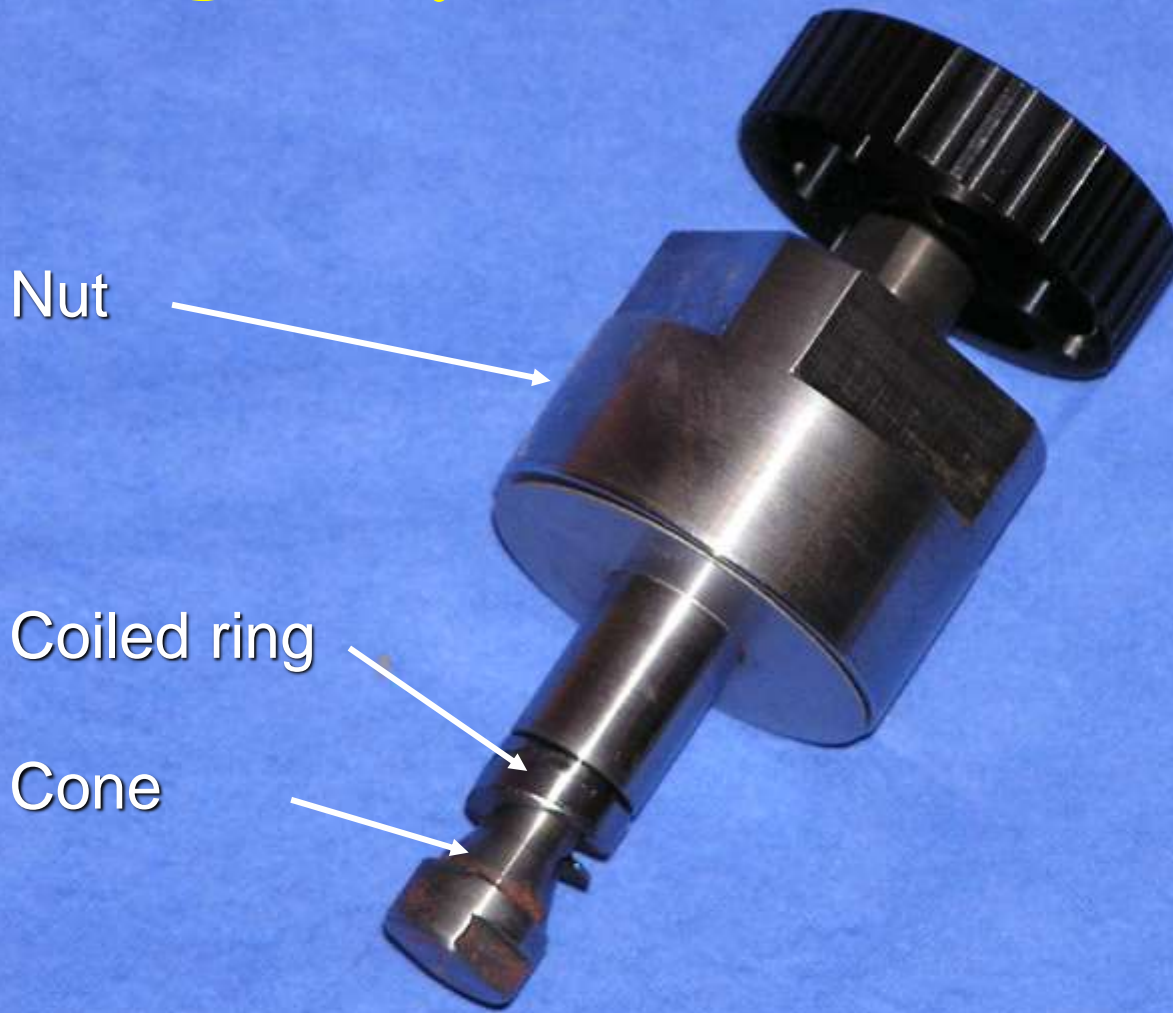
Cut Slot



Insert Expansion Cone with Coiled Split-Ring

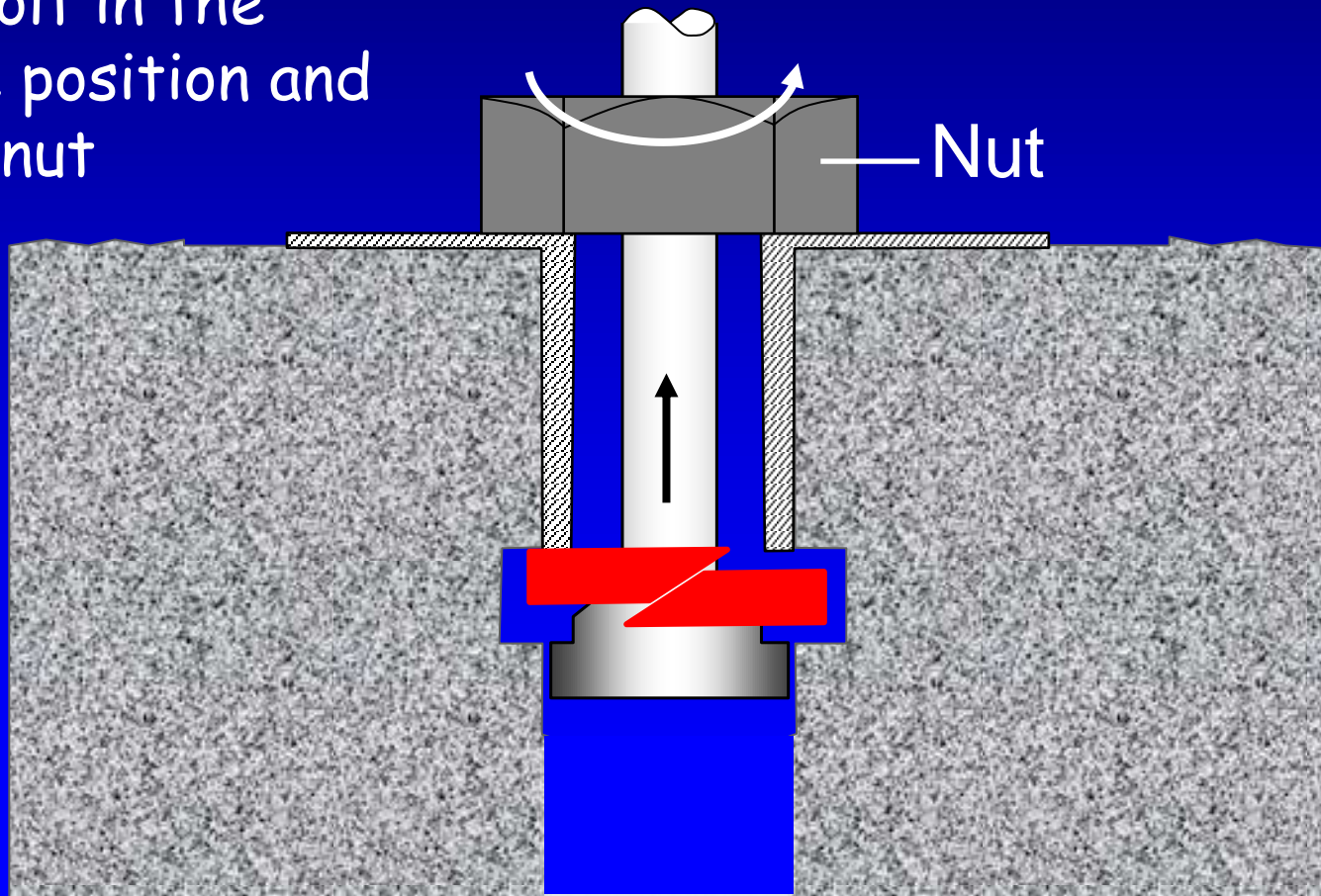


Ring Expansion Hardware



Expand Ring

Hold base/cone
pullbolt in the
same position and
turn nut



Expand Ring

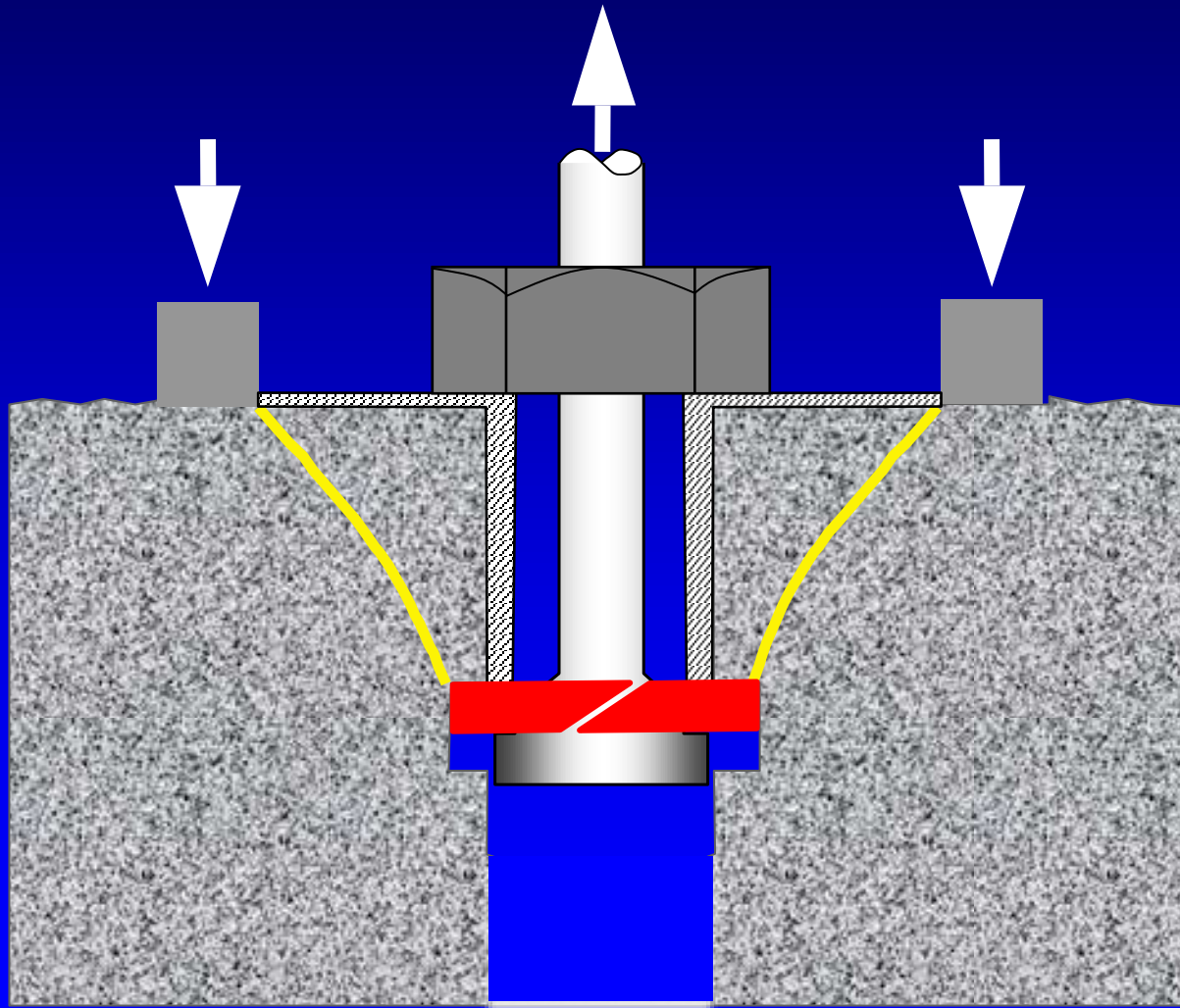
Hold base/cone
pullbolt in the same
position and turn nut
with the 45 mm
wrench 9 rotations
clockwise. Back off
slightly



**Couple
instrument
Apply
Pullout
Force, slowly
to failure**



Pullout the Expanded Ring against the 55 mm counterpressure



Acceptable Test

Sharp 55 mm
diameter edge
from
counterpressure

Crushed
material



Criteria for correct CAPO testing



Max strength for CAPO-TEST and duration of test

- Max pullforce for the CAPO-TEST is 90 kN, equiv. to 105 MPa cylinder strength or 140 MPa cube strength
- Total duration of one test 15-20 minutes

LOK-TEST and CAPO-TEST Instruments

LOK-TEST Instrument in a suitcase



Additional is needed inserts for casting-in, slide 11-12

Test smart – Build right

CAPO-TEST Lite Instrument in a suitcase

For handheld
use without
the suction
plate



Extra, C-112
Expandable
inserts



The pull machine is the same as for LOK-TEST
Can also be used for BOND-TEST

CAPO Equipment, complete set



Prep. Kit



Pullmachine

DSV Kit with
Surface Planner
and Suction Plate



C-112 Expandable
Inserts