

Refer to: HSA-10/SS-116

Mr. Mike Chu
Application/Sales Engineer
Valley Forge & Bolt Manufacturing Co.
1825 South 27th Avenue
Phoenix, Arizona 85009-6417

Dear Mr. Chu:

Thank you for your October 29 letter requesting Federal Highway Administration (FHWA) acceptance of your company's SPC4tm load indicating fasteners as a component of breakaway slip base sign support systems for use on the National Highway System (NHS). You requested that we find these bolts acceptable for use with slip bases on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Introduction

Testing of slip base sign supports has been conducted in compliance with the guidelines contained in the NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features. Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Breakaway slip bases depend upon proper torquing of the bolts to 1) ensure that the bolts will not loosen markedly and fall out due to vibrations and 2) permit the slip base surfaces to move with respect to one another in the event of crash. Your company's specially modified bolts allow a user to check the tension in the bolts once they are installed. This method also provides the opportunity to check the tension after construction to see if the system has "relaxed" to the point where the bolts no longer keep the system stable. Load indicating fasteners can allow a simpler and more accurate periodic inspection.

Findings

It is our opinion that the load indicating bolts will perform in an acceptable manner when used in crash-tested slip base systems in lieu of the conventional bolts that are specified. Therefore, the devices described above and shown in the enclosed product literature for reference are acceptable for use as Test Level 3 devices on the NHS under the range of conditions tested, when proposed by a State.

Please note the following standard provisions that apply to FHWA letters of acceptance:

- Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number SS-116 shall not be reproduced except in full. As this letter and the supporting documentation which support it become public information, it will be available for inspection at our office by interested parties.
- The SPC4tm load indicating fasteners are patented products and are considered "proprietary." The use of proprietary devices specified on Federal-aid projects, except exempt, non-NHS projects: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists or; (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed.

Sincerely yours,

Carol H. Jacoby, P.E.
Director, Office of Safety Design

Enclosure

Sec. 635.411 Material or product selection.

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

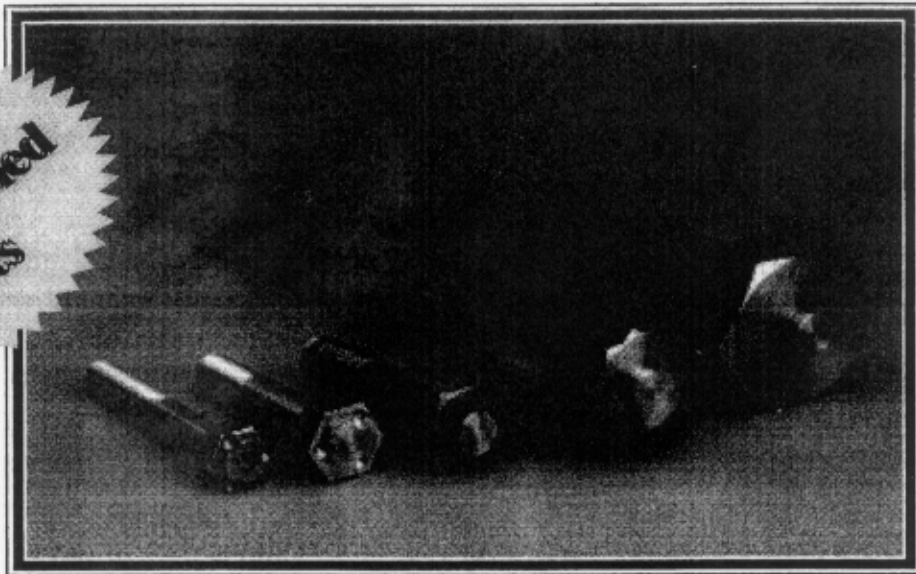
(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.

SPC4™ Load Indicating Fastener

**Safety!
for Assembled
Joints**



The **SPC4™** load indicating fasteners allow users to install a bolted assembly with accuracy and confidence. The user can constantly monitor the clamp load on the bolted joint, whether static or dynamic, by attaching a probe to the datum disc located on the head of the fastener and reading the value on a hand held battery powered digital monitor. Optional data gathering and storage are available.

The integrity of a bolted joint is jeopardized when fasteners lose their tension. This loss of clamping force begins during assembly due to elastic interactions and joint relaxation. Self-loosening continues when the joint is put in service due to vibrations, temperature changes, shock and other variables. The **SPC4™** allows the end-user to tighten **only** the bolts or studs that have lost their clamp load, minimizing expensive downtime and saving money. For a minimal investment, the **SPC4™** offers maximum joint integrity with optimum performance.

The **SPC4™** can be manufactured to many of the ASTM, ISO, SAE or any specified customer standards with various types of head configurations.

- Applications:**
- ◆ Critical Joints
 - ◆ Friction Joints
 - ◆ Flanges
 - ◆ Tension Loaded Joints
 - ◆ Foundation Bolts
 - ◆ Slip Critical Joints
 - ◆ Bearing Joints Requiring Full Pre-Tension
 - ◆ Where Accurate Tension Must be Maintained
 - ◆ Where Ease of Installation is a Must
 - ◆ Gasketed Joints



Valley Forge & Bolt Manufacturing Company

1825 S. 27th Avenue • Phoenix, AZ 85009

Phone: (602) 269-5748 • Fax: (602) 269-7851 • Website: www.vfbolts.com • Email: sales@vfbolts.com

SPC4™ Load Indicating Fastener for Safe

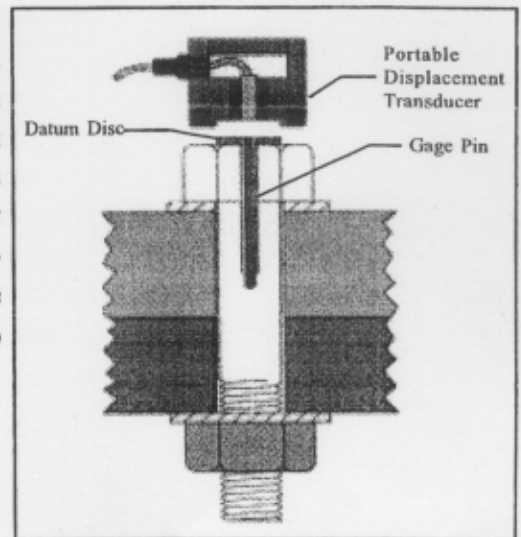
Advantages

- ◆ Accurate Joint Assembly
- ◆ Quick Installation
- ◆ Electronic Control of Installation Clamp Load
- ◆ Tightens to +/- 5% of True Clamp Load
- ◆ Any Tightening Tool can be Used
- ◆ Eliminate the Mystery of Torque Tightening
- ◆ Inexperienced Operators can Complete & Monitor Complex Assemblies
- ◆ Shut-off Capability of Installation Tool at Pre-determined Clamp Load
- ◆ Easily Displays the Amount of Clamp Load via an Electronic Hand Held Unit
- ◆ Capability for Continuous Monitoring
- ◆ Applies Uniform Distributed Load on Gasket Joints
- ◆ Reduces Inspection Time
- ◆ Prevents Expensive Downtime
- ◆ Safer Bolted Joint Assemblies
- ◆ Reduce Maintenance Cost
- ◆ Saves Dollars Optimize Bolted Joint Integrity

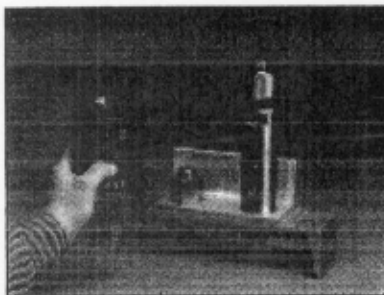
How Does an SPC4™ Function?

A fastener is modified by machining a small hole into the head; this minor engineered modification assures bolt design integrity. A gage pin is inserted into the hole and secured at the bottom. A datum disc is fitted on the top of the bolt head and forms a flat surface with the top of the gage pin when the bolt is unloaded. When the bolt is tightened, it elongates and the gage pin is drawn into the bolt away from the datum disc surface. A portable electronic displacement transducer measures the distance between the datum disc surface and the top of the gage pin. The elongation of the bolt is then correlated to joint clamp load via an electronic hand held monitor.

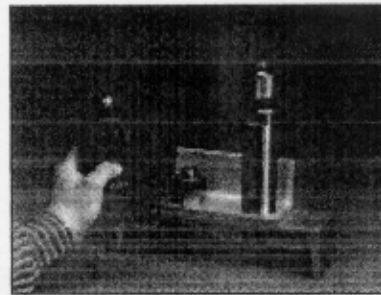
SPC4™ load indicators operate within the elastic limit of the bolt material in accordance with Hook's Law.



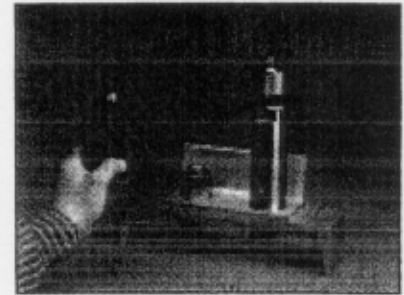
Load Progressions



Part with
Zero Load



Part with 50% at
Proof Load

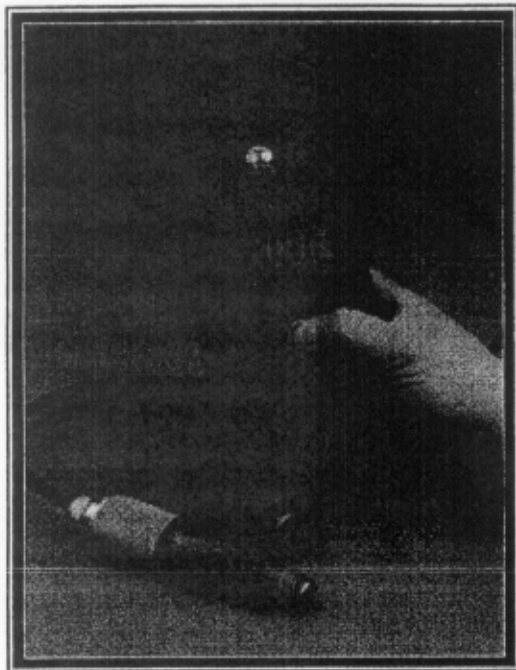


Part with 90% at
Proof Load

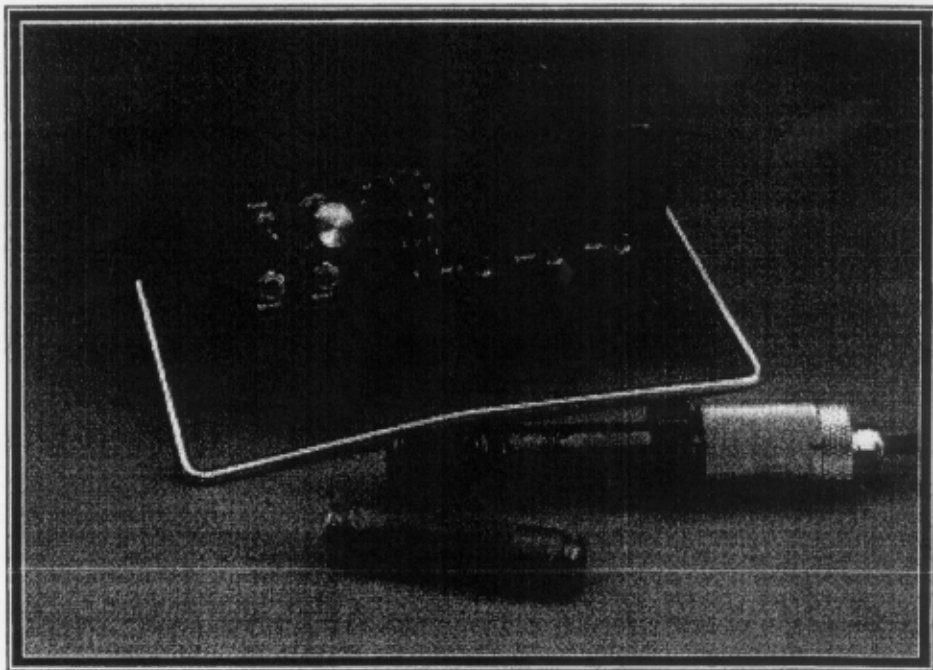
and Accurate Bolted Assemblies

SPC4™ Load Indicator Monitor Models:

- ◆ SPC-400 Series: A portable hand-held monitor that displays bolt load (joint clamp load) as a percentage of its proof load.



SPC-400 Series



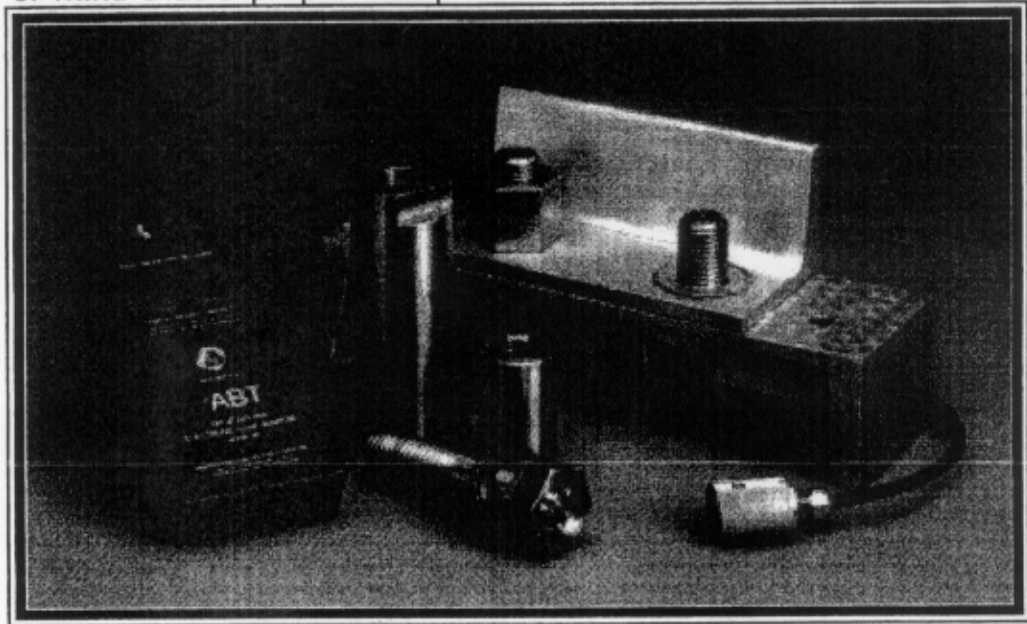
SPC-420, 440, 460 Series

- ◆ SPC-420 Series: The portable SPC-420 Series monitor provides an additional feature; it can be coupled to a power tightening tool that shuts it down at the predetermined joint clamp load.
- ◆ SPC-440 Series: The portable SPC-440 Series monitor incorporates the features of the SPC-400 and SPC-420 Series monitors with the capability of downloading data from a single bolt to a computer.
- ◆ SPC-460 Series: The portable SPC-460 Series incorporates the features of the SPC-440 Series with a multi-channel unit, that can simultaneously monitor the performance of any number of bolted joints. Results can be displayed and stored for permanent record keeping.

Foundation Bolt "RetroKit"

The **Foundation Bolt RetroKit** is an engineered system that provides real time measurement of the bolt load via our SPC4™ bolt technology. The bolt load is displayed in a digital format via a portable hand held unit. This system

is designed for retrofitting existing foundation bolts, as well as, in new installations where accurate clamp load must be maintained. The foundation bolt RetroKit system is ideal when a routine tightening schedule is a requirement. It allows the technician to only tighten the bolts that have lost their clamp load and avoid over tensioning of a given stud that may lead to expensive replacement cost. This system allows the engineer and the contractor the peace of mind that a proper clamp load has been achieved and maintained.



1. **Inner Coupling** – Attaches to existing foundation stud; this part is under tension.
2. **Outer Cylinder** – Provides a load surface for the hardened washer and SPC4™ bolt; this part is under compression.
3. **SPC4™** – Allows the user to monitor clamp load in a digital format via an electronic hand held unit (purchased separately).
4. **Probe** – To be placed on the datum disc on the fastener head.

Advantages:

- ◆ Inspection Time Reduced
- ◆ Reduce Maintenance Cost
- ◆ Avoids Breaking or Stripping of Studs During Scheduled Maintenance
- ◆ Avoids Expensive Damage to Equipment
- ◆ Provides Safe and Accurate Installation