SHELLOCK
R & D SERVICES, INC.

7511 McConnell Avenue
Los Angeles, CA 90045
(310) 670-7095 voice (310) 417-8639 fax
www.MagneticResonanceSafetyTesting.com

REPORT
Magnetic Field Interaction Testing Conducted at 3-Tesla on Four Fire Extinguishers:

Model B270NM, 1 3/4 gallon Water Mist
Model B272NM, 2 1/2 gallon Water Mist
Model 322, 5.0 lb. CO_2
Model 331, 15.0 lb. CO_2

Project Conducted by:
Frank G. Shellock, Ph.D.
Shellock R & D Services, Inc.
7511 McConnell Ave.
Los Angeles, CA 90045

10/22/04

Presented to:
Marc Stewart
Amerex Corporation
P.O. Box 81, 7595 Gadsden Highway
Trussville, AL 35173-0081

This report pertains to magnetic field interaction testing conducted at 3-Tesla on the following fire extinguishers from Amerex Corporation:

1. Model B270NM, 1 3/4 gallon Water Mist
2. Model B272NM, 2 1/2 gallon Water Mist
3. Model 322, 5.0 lb. CO_2
4. Model 331, 15.0 lb. CO_2

According to information form the Amerex Corporation, these fire extinguishers are made from non-magnetic materials and are intended for use in a high magnetic field environment such as that associated with a magnetic resonance (MR) system.

NOTE: These fire extinguishers are intended for use inside of the MRI environment (e.g., in the MR system room, close to the scanner). However, they will not be utilized directly inside of the MR system (e.g., inside of the bore of the scanner), itself. As such, the assessment of magnetic field interactions for these fire extinguishers specifically involved a qualitative evaluation of translational attraction to the powerful magnetic field of a 3.0-Tesla MR system, *only.*

A limited, qualitative assessment of the functional aspects of the fire extinguishers was also conducted. That is, each fire extinguisher was "activated" for approximately 5-seconds while in close proximity (within 2 feet) to the 3-Tesla MR system.

MAGNETIC FIELD INTERACTIONS

The tests for magnetic field interactions for the four different fire extinguishers were conducted with regard to exposure to a shielded, 3.0-Tesla MR system (General Electric Medical Systems, Milwaukee, WI). This is a "short-bore", actively-shielded, MR system. The direction of the magnetic field for the 3-Tesla scanner is horizontal. The highest spatial gradient for the 3-Tesla MR system (General Electric Medical Systems, Milwaukee, WI) occurs at a position that is 74-cm from isocenter of the scanner. The magnetic spatial gradient at this position is 720 gauss/cm.

For the assessment of magnetic field interactions, each fire extinguisher was first assessed by applying a nylon rope securely around the device. The end of the rope was held by two men that remained a suitable distance from the 3.0-Tesla MR system to prevent the fire extinguisher from becoming a projectile in the event that substantial magnetic field interactions were present.

Each fire extinguisher was slowly moved towards the MR system in a methodical, incremental manner. Accordingly, each fire extinguisher was placed as close as possible relative to the bore of the 3.0-Tesla MR system.

A small amount of "slack" was intentionally allowed in the rope so that any magnetic field interactions could be readily detected (i.e., as the slack would be quickly taken up if the fire extinguisher was attracted by the 3.0-Tesla MR system).

Accordingly, each fire extinguisher was brought up to the entrance of the bore of the 3-Tesla MR system, which is essentially considered to be a "worst-case" position for a device used externally to the MR system.

Each fire extinguisher was then placed on a platform and rotated 360 degrees relative to the bore of the MR system (approx. three feet from the scanner) and then moved up to a position that was approximately 2-inches from the entrance of the bore of the MR system. This was done to qualitatively determine if there was any influence of the static magnetic field on the position of the fire extinguisher, or if the fire extinguisher attempted to "align" to the magnetic field (i.e., another indication that "positive" magnetic field interactions are present). Photographs were taken in order to illustrate the tests performed on these devices (see attached).

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

Finally, each fire extinguisher was “activated” for a period of approximately 5-seconds to qualitatively assess the function of the device.

Results and Discussion
The following results were noted:

1. Model B270NM, 1 3/4 gallon Water Mist: no magnetic field interactions for the tank or “hose” portion

2. Model B272NM, 2 1/2 gallon Water Mist: no magnetic field interactions for the tank or “hose” portion

3. Model 322, 5.0 lb. CO_2: no magnetic field interactions for the tank or “hose” portion

4. Model 331, 15.0 lb. CO_2: no magnetic field interactions for the tank, substantial magnetic field interactions exhibited by the “hose” portion

Accordingly, there were no “free movements” (i.e., no evidence of translational attraction, rotation, or alignment) seen for the “tanks” of the four different fire extinguishers with respect to exposure to the 3.0-Tesla MR system.

The hose portions of Model B270NM, 1 3/4 gallon Water Mist, Model B272NM, 2 1/2 gallon Water Mist, and Model 322, 5.0 lb. CO_2 were also “nonmagnetic”.

Notably, the “hose” portion of Model 331, 15.0 lb. CO_2 was highly magnetic.

Each fire extinguisher was successfully activated for 5-seconds during exposure to the 3-Tesla MR system. There was no evidence of problems with this procedure.

Recommendations
During exposure to the 3.0-Tesla MR system, there were no qualitative signs of magnetic field interactions for the following:

1. Model B270NM, 1 3/4 gallon Water Mist
2. Model B272NM, 2 1/2 gallon Water Mist
3. Model 322, 5.0 lb. CO_2

Therefore, given the “intended use” of these specific types of fire extinguishers (i.e., to be positioned outside of the MR system, but brought into the 3.0-Tesla MR system room to extinguish a fire), they should be considered “safe” for use in an MRI environment associated with MR systems operating at 3.0-Tesla or less. It should be noted that the test results are specific to the MR system utilized in this assessment of magnetic field interactions.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

For Model 331, 15.0 lb. CO_2, while the “tank” showed no magnetic field interactions at 3-Tesla, the “hose” portion was substantially attracted to the 3-Tesla MR system. As such, this may present a serious problem or issue for its use in a 3-Tesla MRI environment. Accordingly, if the Model 331, 15.0 lb. CO_2 device is intended for use in the MRI setting, the hose portion will require modification, utilizing non-magnetic materials.

IMPORTANT NOTE: If you plan to use this information for labeling or promotion of these fire extinguishers as being “non-magnetic” or for use in the MRI environment, please provide me with the content to review in order to ensure proper presentation of the information.

DISCLAIMER

The information in this report is provided without warranty of any kind, either expressed or implied including without the limitation of implied warranties of merchantability and fitness for a particular purpose. The author of this report, Magnetic Resonance Safety Testing Services, and Shellock R & D Services, Inc. shall not be held liable for any direct, indirect, consequential, special or other damages suffered by the manufacturer of the device or product or by other parties, as a result of the use of the report results, data, or other deliverables.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

FIGURE 1. The 3.0-Tesla MR system (General Electric Medical Systems, Milwaukee, WI) used for assessment of magnetic field interactions for the four different fire extinguishers from the Amerex Corporation.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

FIGURE 2. Testing the Model B270NM, 1 3/4 gallon Water Mist fire extinguisher for magnetic field interactions during exposure to a 3.0-Tesla MR system. Note the lack of magnetic field translational attraction for this fire extinguisher.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

FIGURE 3. Testing the Model B272NM, 2 1/2 gallon Water Mist fire extinguisher for magnetic field interactions during exposure to a 3.0-Tesla MR system. Note the lack of magnetic field translational attraction for this fire extinguisher.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

FIGURE 4. Testing the Model 322, 5.0 lb. CO_2 fire extinguisher for magnetic field interactions during exposure to a 3.0-Tesla MR system. Note the lack of magnetic field translational attraction for this fire extinguisher.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045

FIGURE 5. Testing the Model 331, 15.0 lb. CO_2fire extinguisher for magnetic field interactions during exposure to a 3.0-Tesla MR system. While the “tank” showed no magnetic field interactions at 3-Tesla, the “hose” portion was substantially attracted to the 3-Tesla MR system. As such, this may present a serious problem or issue for its use in a 3-Tesla MRI environment.

SHELLOCK R & D SERVICES, INC.
7511 McConnell Ave., Los Angeles, CA 90045