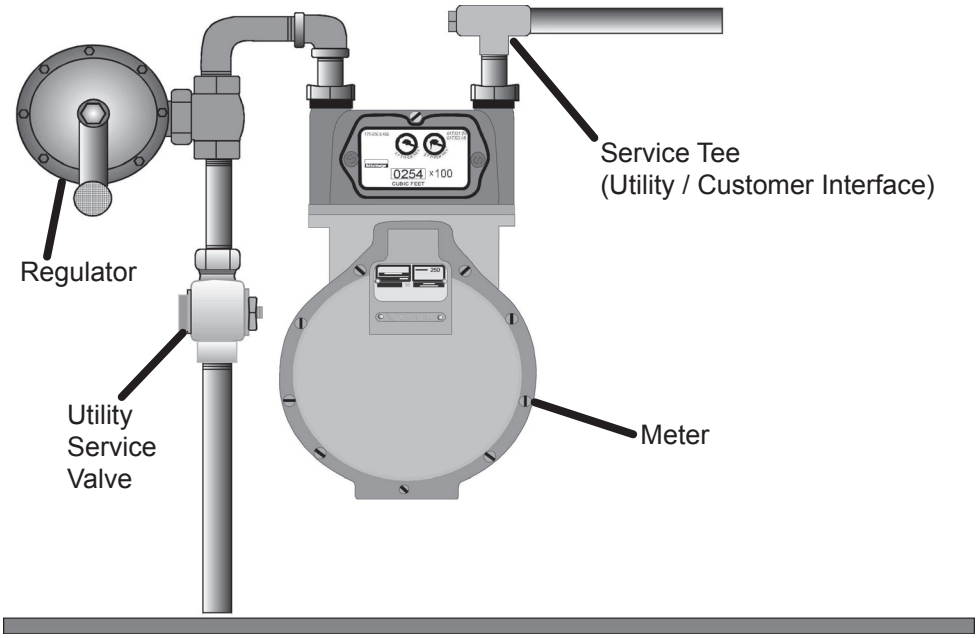
ATC 74

Collaborative recommended requirements for automatic natural gas shutoff valves in Italy



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ATC-74

Collaborative Recommended Requirements for Automatic Natural Gas Shutoff Valves in Italy

by

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Preface

In July 2007, the Seismic Risk Office (SRO) of the Italian Civil Protection Department (ICPD)[1] in Rome, Italy, awarded a contract to the Applied Technology Council (ATC)[2] of the United States to prepare a support document containing recommended requirements for automatic natural gas shutoff valves in Italy. The objective of the project was to provide documentation and recommendations pertaining to:

- State-of-the-art information on automatic natural gas shutoff valves;
- Levels of earthquake intensity that should trigger gas shutoff valves;
- U.S. perspective on issues affecting the qualification procedures described in the ASCE 25-97 Standard, *Earthquake-Actuated Automatic Gas Shutoff Devices* (ASCE, 1997);
- The goal of gas shutoff valves and perspective on related insurance issues;
- Procedures for the qualification of gas shutoff valves;
- Most suitable types of passive and active devices; and
- Responsibilities for installation, check and reactivation.

Developed over a period of several months, this resulting support document contains: (1) technical background information, including information related to the development of requirements in ASCE 25-97; (2) a brief review of considerations and actions in the United States related to assuring adequate natural gas safety in earthquakes; (3) an assessment of issues related to the adoption of ASCE 25-97 as a standard for earthquake actuated automatic gas shutoff devices in Italy; (4) a summary and recommendations; and (5) a series of appendices containing example U.S. jurisdiction ordinances pertaining to gas shutoff valves and related information.

ATC gratefully acknowledges the project participants who developed this report: technical consultant Douglas G. Honegger, who served as the principal report author; Italian Project Engineering Panel (PEP) members Luigi De Angelis, Adriano De Sortis, Giacomo Di Pasquale, and Luca Ponticelli; and U.S. PEP members Massoud H. Abolhoda, Patrick Buscovich (ATC Board representative), William T. Holmes, Jeremy Isenberg, Stuart P. Nishenko, and Donald R. Parker. Peter N. Mork produced the camera-ready copy and A. Gerald Brady edited the report. The affiliations of these individuals are provided in the list of project participants.

Christopher Rojahn
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[1]The Seismic Risk Office of the Italian Civil Protection Department promotes a wide variety of activities, including studies of earthquakes effects on buildings, theoretical and experimental studies on materials, constructive elements and technologies to be used in seismic areas, studies on seismic upgrading of existing buildings, seismic zoning, support for updating the seismic codes, development of criteria, strategies, and priorities for seismic risk assessment and reduction, and activities for information, education, and technical training in the field of engineering seismology, earthquake engineering and emergency management.

[2]The Applied Technology Council (ATC) is a United States of America professional non-profit corporation founded to develop user-friendly engineering applications for natural hazard mitigation. Over the last 30 years, ATC has prepared numerous recommended guidelines and procedures for agencies of the U.S. Government on a wide range of topics, including seismic risk evaluation and reduction procedures, engineering approaches, and engineering specifications for eventual code adoption. Several projects and technical reports have been developed in prior cooperative efforts between the Italian Civil Protection Department and ATC (the ATC-51 Report, *U.S.-Italy Collaborative Recommendations for Improved Seismic Safety of Hospitals in Italy*; the ATC-51-1 Report, *Recommended U.S.-Italy Collaborative Procedures for Earthquake Emergency Response Planning for Hospitals in Italy*; and the ATC-51-2 Report, *Recommended U.S.-Italy Collaborative Guidelines for Bracing and Anchoring Nonstructural Components in Italian Hospitals*).

Executive Summary

This report addresses issues related to the use in Italy of earthquake actuated automatic gas shutoff devices meeting U.S. standards. The need for this assessment is related to current Italian building code provisions that require gas service in excess of 50 cubic meters per hour be automatically shut off in the event of an earthquake. Although changes to the Italian seismic code are under review, which would modify (probably starting from 2008) the requirements to no longer require automatic shutoff of gas in an earthquake, the use of earthquake activated automatic gas shutoff devices is being considered as a means to meet the modified requirements of limiting the risk of uncontrolled gas leakage.

The need for sufficient information to determine if a state-wide mandate was needed for the installation of earthquake actuated automatic gas shutoff valves in California prompted the California Seismic Safety Commission (CSSC) to undertake a study of natural gas safety in earthquakes. As a result of this study, the CSSC took a position against a state-wide mandate, preferring to have decisions on what measures are appropriate to improve post-earthquake fire safety be made by individual communities.

It is assumed that the present and proposed Italian code requirements are based upon the impact of earthquake damage to gas piping on risks related to post-earthquake fire. As discussed in this report, controlling post-earthquake fire risks requires the consideration of a multitude of factors (beyond the potential for damage to gas services within buildings) that will vary among different localities. Developing plans to reduce the risks of post-earthquake fires requires a coordinated effort that should include the design of gas and electrical components along with an assessment of fire-fighting resources, land-use planning measures that can decrease the likelihood of fire spread, encouraging the use of flame-resistant building materials, public education, and training. In addition, consideration needs to be given to what measures can be implemented to reduce the post-earthquake fire risk in the existing building inventory, which comprises the greatest source of risk and will not be widely affected by new code requirements.

At present no specific Italian standard exists for the qualification of automatic shutoff valves that are becoming available on the national market, so the ASCE 25-97 Standard, *Earthquake-Actuated Automatic Gas Shutoff Devices* (ASCE, 1997) is being considered as a possible reference.

Two key issues have been identified in assessing the appropriateness of ASCE 25-97 for adoption in Italy:

- Differences in the typical building stock: reinforced concrete and masonry in Italy versus wood frame in the United States.

  Although ASCE 25-97 was developed in part based upon the response of predominantly wood-frame residential buildings in the 1994 Northridge earthquake, and such is clearly stated in the standard, the type of building is typically not considered in practice or in ordinances requiring earthquake actuated automatic gas shutoff valves in California. For this reason, differences in the building stock considered in developing ASCE 25-97 and the building stock in Italy are not considered a significant impediment to adopting ASCE 25-97.

- Differences in common gas meter installations: installations at the story of the customer's living unit in Italy versus installations at a single location at grade in the United States.

  If earthquake actuated automatic gas shutoff devices are considered for such installations, it is recommended that (1) gas meters be relocated to the ground floor and devices be installed in accordance with ASCE 25-97 or (2) the device be installed on the utility's piping at grade. These modifications are recommended to avoid unnecessary gas shutoff when building motions in the upper floors of a building are greater than the ground motion at the building foundation.

Establishing requirements for installation of earthquake actuated automatic gas shutoff devices in Italy should be accompanied by the creation of an appropriate regulatory body responsible for assuring devices sold in Italy actually conform to

ASCE 25-97 or other supplemental or alternative standards. At present, the best model for such regulatory oversight is that followed by the California Division of the State Architect with respect to certifying device performance, assuring manufacturer quality control measures, and approval of testing agencies qualified to perform certification testing. It is also recommended that procedures be put in place to track the device installation location so that performance of devices can be evaluated following future earthquakes.

The report identifies several options, in addition to earthquake actuated automatic gas shutoff devices, that can be an effective means to improve natural gas safety, each with its own benefits and drawbacks. With respect to earthquake actuated automatic gas shutoff devices, the primary drawback is the potential for a large number of such devices to lead to extended periods of gas service interruption following an earthquake (estimated to be a few weeks to a few months if a large earthquake struck Los Angeles or San Francisco and all gas services had devices installed).

With respect to existing buildings, earthquake actuated automatic gas shutoff devices are not considered an effective means to improve safety substantially in existing buildings that are highly vulnerable to earthquakes. Emphasis needs to be placed on reducing the vulnerability of the buildings. Experience in California indicates that the most effective means of improving the seismic resistance of existing buildings is a combination of mandatory retrofit requirements and incentive programs to ease the financial and regulatory compliance obstacles to building owners.

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