PUBLICLY AVAILABLE SPECIFICATION

ISO/PAS 12006-3

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Building construction — Organization of information about construction works —

Part 3: Framework for object-oriented information exchange

Construction immobilière — Organisation de l'information des travaux de construction —

Partie 3: Schéma pour l'échange d'information basée sur l'objet

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this Publicly Available Specification ISO/PAS 12006-3 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/PAS 12006-3 was prepared by Technical Committee ISO/TC 59, *Building construction*, Subcommittee SC 13, *Organization of information about construction works*.

ISO 12006 consists of the following parts, under the general title *Organization of information about construction works:*

— *Part 2: Framework for classification of information*

— *Part 3: Framework for object-oriented information exchange*

ISO 12006-2 provides a framework for a classification, rather than the object-oriented approach of this part of ISO 12006. The two parts should be regarded as complementary rather than contradictory. Each has been developed and published in the belief that it has an important role to play in the organization of information about construction works[1)].

While ISO 12006-2 reflects many years of refinement of classification systems, this part of ISO 12006 represents not so much new thinking, but a new implementation of established information modelling practice using a new ISO process which aims to bring new work of this kind into use as quickly as possible. Feedback is a vital component of the development process and will be welcomed, via the secretariat of ISO/TC 59/SC 13.

Annex A of this part of ISO 12006 is for information only.

1) ISO 12006-1 has been cancelled.

Introduction

Over the last few years much work has been undertaken in structuring technical information for construction works. In particular, two approaches have been pursued within ISO: “classification” and “object-orientation.”

The former has seen the development of a new International Standard, ISO 12006-2, which embraces many of the classification systems which have arisen since the first formal construction classification, SfB, was introduced in Sweden in 1950. The general approach taken by these is that they organize things by some characteristic or aspect, which might be described as “views” or “facets”.

The “object-oriented” approach describes the characteristics of things without a grouping preference or an ordering by specialization. In the object-oriented approach, the object is central, thus acting as a container of characteristics. Such an approach is exemplified in International Standards such as those in the ISO STEP series (ISO 10303), or EPISTLE (ISO 15926). It is also known as “product modelling”. An object can be grouped with the help of classification systems that take one or more characteristics of the object for the grouping.

A number of ISO technical committees (as well as a number of related bodies outside ISO) considered that these methodologies needed to be reconciled in order to bring together the overlapping interests of users of computer-aided drafting systems, specifiers and suppliers of reference material, and form a “content bridge” between new object-oriented software and older legacy systems, in particular databases of construction information.

In addition to these approaches, several new technologies such as XML (eXtensible Mark-up Language), and IFC (Industry Foundation Classes), which have special importance for exchange of information about construction works, are currently under active development and implementation.

At a meeting of representatives of ISO technical committees and other bodies with an interest in construction information content and exchange technology, held in Vancouver in June 1999, it was agreed that

— a common terminology about objects and their attributes would be beneficial for information exchange in the construction industry, and

— there should be an International Standard which describes a framework for such a terminology in the form of a formal information model.

ISO/TC 59/SC 13 formed a working group, WG 6, to develop the standard and it determined that the framework should provide for

— definition of concepts,

— definition of relations between concepts, and

— naming of concepts (with multilingual capacity).

Real-life objects can be grouped in classes, e.g. the four walls of a given room belong to the conceptual class “wall”. Relations, properties, etc., and groups of classes can be objects as well, e.g. the size of a wall, or the U-value of a wall. A model is a representation of a part of the real world, e.g. a model predicting the heat flow through a wall under given conditions. A meta-model is a model of the model, e.g. if grammar defines how a language should be used, then grammar is a meta-model for languages. A very formal and precisely defined language for information models is EXPRESS and its graphical representation EXPRESS-G. In this part of ISO 12006, EXPRESS and EXPRESS-G are used.

The model specified provides the ability to define concepts. Concepts are objects defined by properties. Objects and properties can have relationships and can be grouped. Objects, grouping and relationships are the basic entities of the model. The set of properties or groups of properties associated with an object provide the formal

definition of the object as well as its typical behaviour. Properties have values, optionally expressed in units. Values form the semantic content of a concept, thus providing, through several aggregation levels, its ultimate formal description.

The role that an object is intended to play can be designated through the model and this provides the capability to define the context within which the object is used. Each object may have multiple names and this allows for its expression in terms of synonyms or in multiple languages. Each object is always named in English (the default language) and may also be named in terms of the language of the location in which it is determined or used. Objects may be related to formal classification systems through the provision of classification references.

The model has one Root class from which the following three classes inherit: Objects, Groups and the Relationships between them. The Root class provides the ability to assign any set of names, labels and descriptions, in any language, to its derived types, as well as identifiers and dates.

Objects are divided into Subjects, References, Activities, Units and Properties. Subjects are the things that are described. References provide the means to associate external documents, such as standards, regulations and classification systems, to the Objects. The other classes are description classes related to other Objects and themselves through Relationships.

Relationships provide an association mechanism between Objects. Relationships are divided into Association, Specialization, Composition, Involvement (acting upon), Property assignment, Grouping and Value assignment.

Groups provide for all kinds of groups of Objects, including nested Groups, by means of the Grouping Relationships.

Properties are classes for the storage of data. Data are Values with optionally associated Units, and are assigned to Properties by means of the Value assignment Relationship. This Relationship makes a distinction between several – enumerated – Value assignment roles, such as Nominal Values, and Upper or Lower boundary Values.

The meta-model described in this part of ISO 12006 can have numerous uses but its principal potential lies with the development of the precise “sets of words” needed to maximize the efficiency of product models and e-business for construction works.

A set of words can be called a terminology, a vocabulary or a lexicon and in this context these terms are more or less interchangeable. Sets of words have long been published as printed dictionaries but it is expected that the sets of words which this specification represent, will enable the publishing of electronic dictionaries.

Because this specification has a *lexical* function — it is to do with the words used in communication about buildings — the prefix “Lex” has been adopted within the model. For sets of words, “vocabulary” has been used rather than “terminology” as being the most commonly understood term.

Building construction — Organization of information about construction works —

Part 3:
Framework for object-oriented information exchange

1 Scope

This part of ISO 12006 specifies a language-independent information model which may be used for the development of vocabularies used in information about construction works.

It enables classification systems, information models, object models and process models to be referenced from within a common framework.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 12006. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12006 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

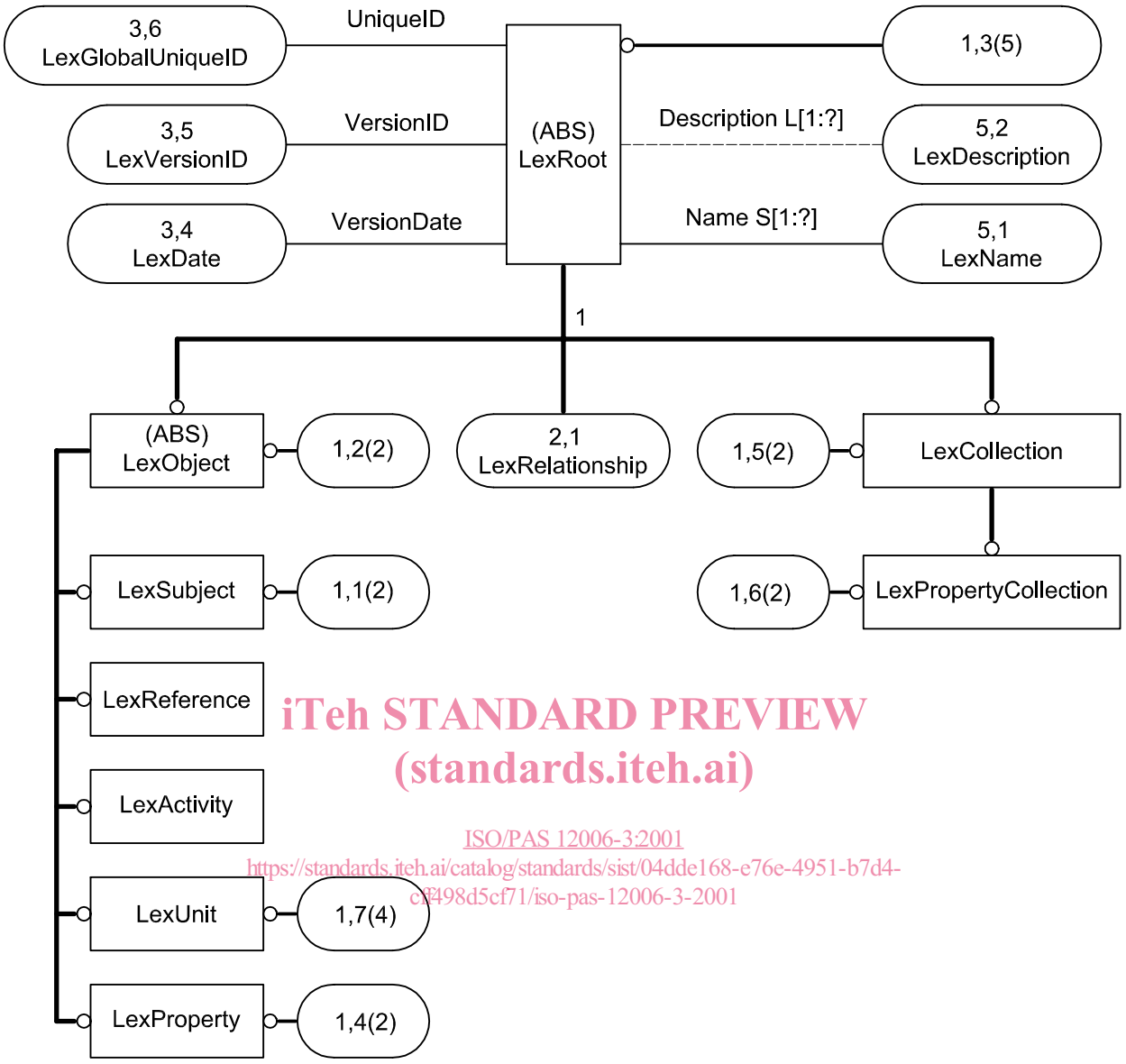
3 Terms and definitions

For the purposes of this part of ISO 12006, the terms and definitions given in ISO 10303-11 apply.

4 Specification

ISO/PAS 12006-3, version 1, is described in the EXPRESS-G diagrams shown in Figures 1 to 5. Following those, the formal definition is given in EXPRESS.

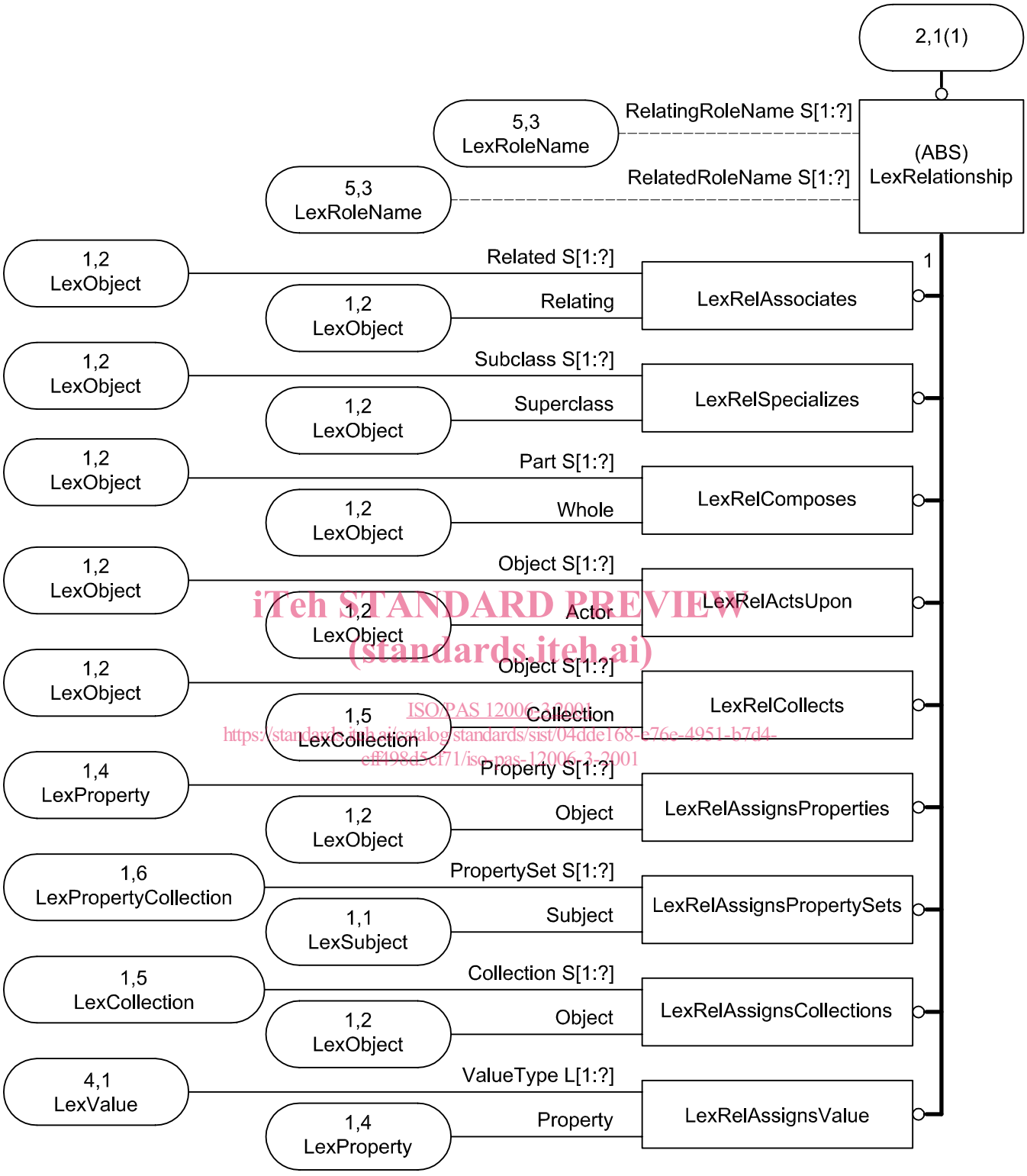
The conventions used in the development of this specification are given in annex A. These conventions do not apply to the population or use of the framework.



TOP LEVEL STRUCTURE

From the Root the model is divided into three main concepts: Objects, Collections and the Relationship between them. Names, descriptions and identifiers are inherited from the abstract Root object.

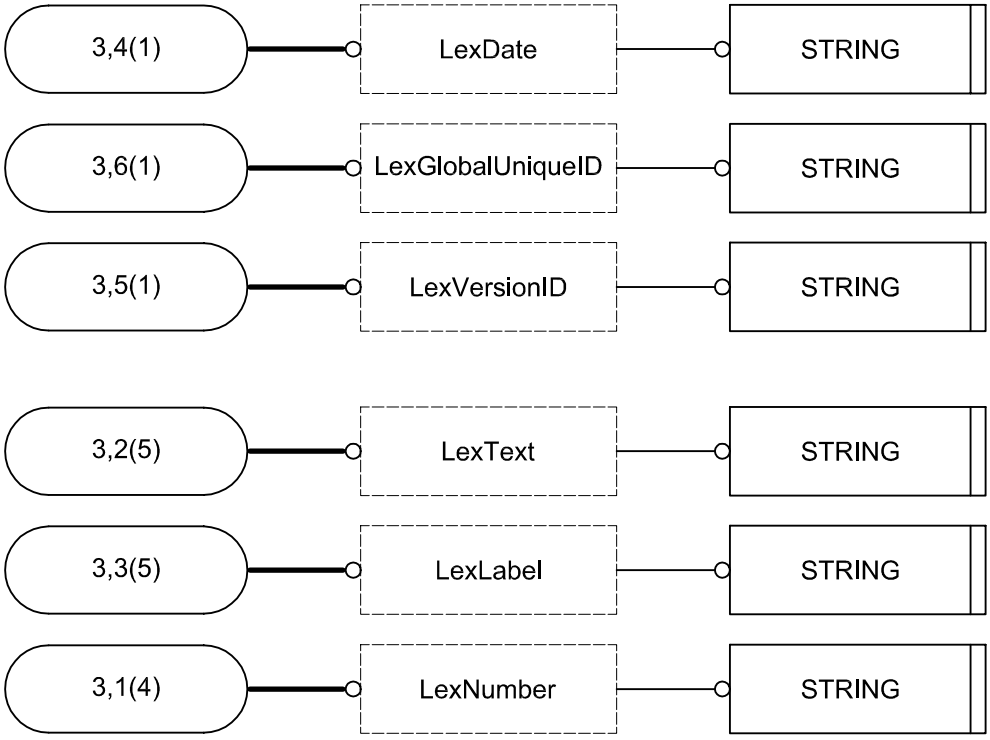
Figure 1 — EXPRESS-G diagram 1



RELATIONSHIPS

The models have both generic and specific relationships. The most generic relationship is LexRelAssociates which can be given any name and set of roles through the abstract LexRelationship.

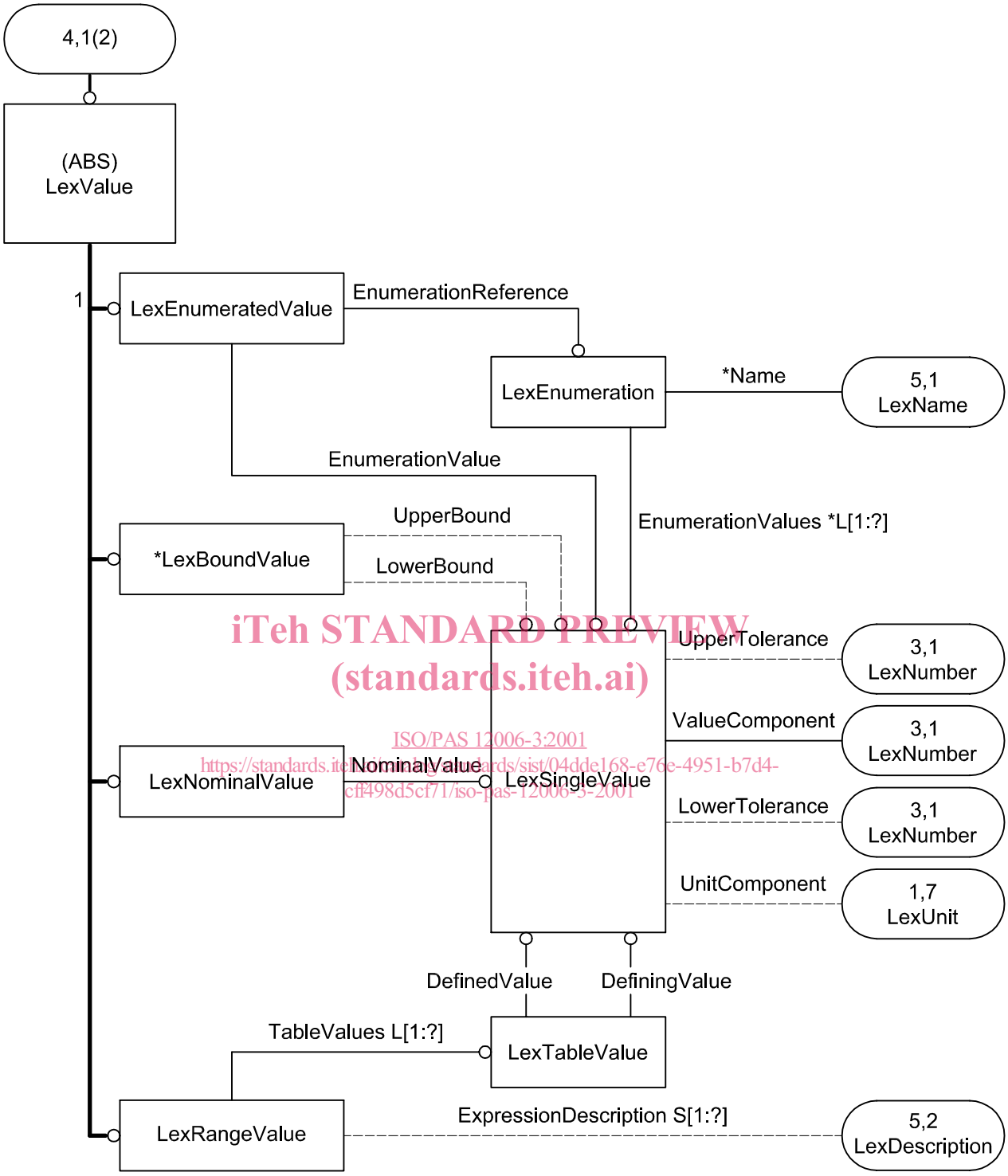
Figure 2 — EXPRESS-G diagram 2



SIMPLE TYPES

All text and numbers are assigned through the use of Defined types. All values are stored as Strings while the formatting lies in the definition of the Defined type.

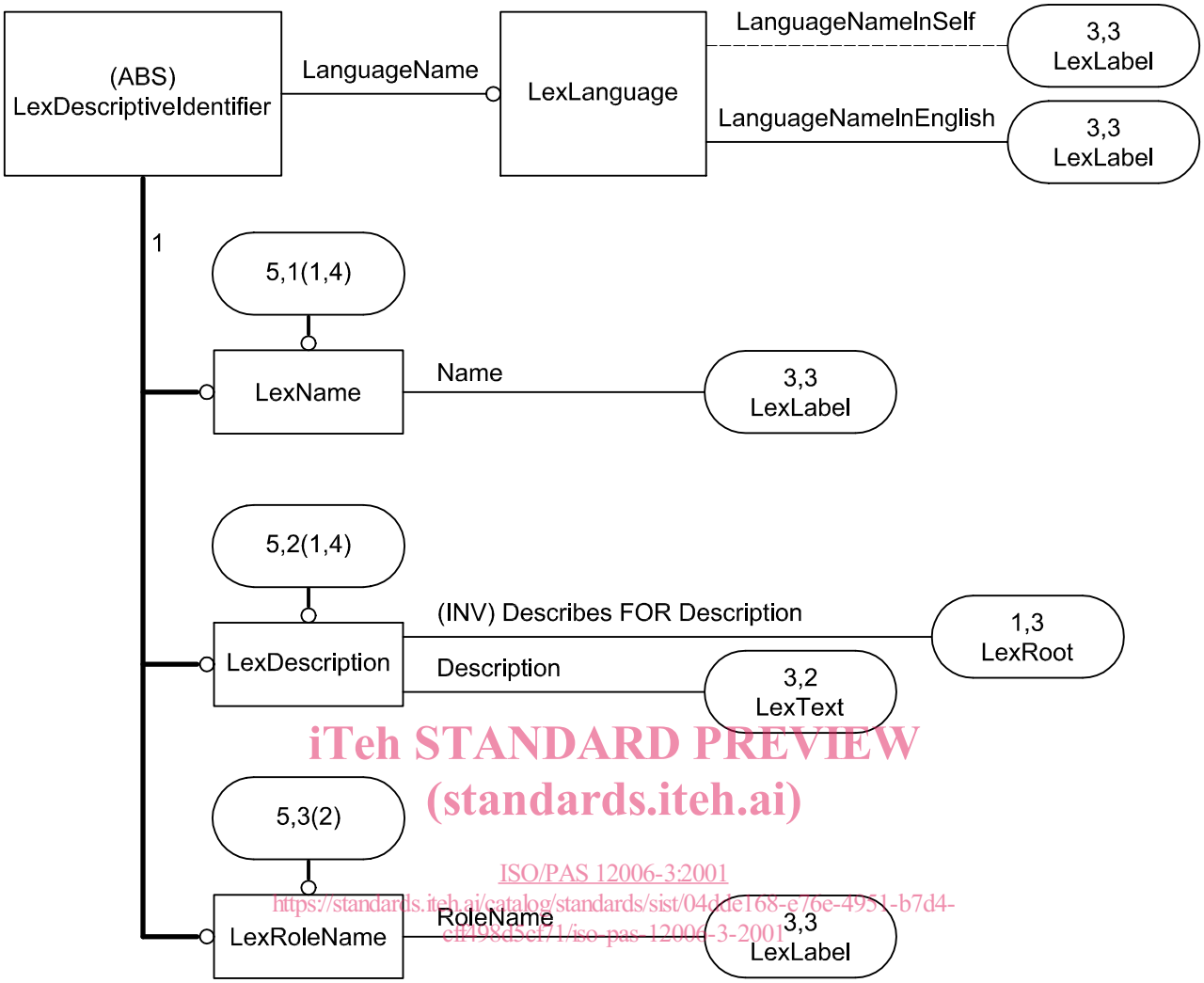
Figure 3 — EXPRESS-G diagram 3



VALUE TYPES

The mechanism to create all types of values and tolerances, which can be assigned to properties. LexValue is not a subtype of LexRoot.

Figure 4 — EXPRESS-G diagram 4



DESCRIPTIVE TYPES

Allows you to add any number of names and descriptions to any object. The names will always be of a particular language. The model also allow you to name roles of Relationships. LexDescriptiveIdentifier is not a subtype of LexRoot.

Figure 5 — EXPRESS-G diagram 5