

Preprocessed HAL/S

BNF-converter

January 4, 2025

This document was automatically generated by the *BNF-Converter*. It was generated together with the lexer, the parser, and the abstract syntax module, which guarantees that the document matches with the implementation of the language (provided no hand-hacking has taken place).

The lexical structure of HAL/S

Literals

NeqToken = ([“~”] | {“NOT”}[“ ”]*)[“=”]
LeToken = ([“~”] | {“NOT”}[“ ”]*)[“>”] | {“<=”}
GeToken = ([“~”] | {“NOT”}[“ ”]*)[“<”] | {“>=”}
NoArgUserFuncIdentifierToken = {“nf_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
BitIdentifierToken = {“b_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
BitFunctionIdentifierToken = {“bf_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
CharFunctionIdentifierToken = {“cf_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
CharIdentifierToken = {“c_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
StructIdentifierToken = {“s_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
StructFunctionIdentifierToken = {“sf_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
LabelToken = {“l_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
EventToken = {“e_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
ArithFieldToken = {“a_”}⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
IdentifierToken = ⟨letter⟩(((⟨letter⟩ | ⟨digit⟩ | {“_”}) * (⟨letter⟩ | ⟨digit⟩)))?
StringToken = [“”](⟨letter⟩ | ⟨digit⟩ | {“”}) | [“_+−”% \$()|*./&~=<>#@,;:}{!?’”])* [“”]
TextToken = [“”](⟨letter⟩ | ⟨digit⟩ | [“_+−”% \$()|*./&~=<>#@,;:}{!?’”])* [“”]
LevelToken = [“123456789”] | [“12”]⟨digit⟩ | [“3”][“012”]
NumberToken = ⟨digit⟩+
CompoundToken = (⟨digit⟩ + ([“.”]⟨digit⟩)*)? | [“.”]⟨digit⟩+([“EBH”][“−”?⟨digit⟩+)*

Reserved words and symbols

The set of reserved words is the set of terminals appearing in the grammar. Those reserved words that consist of non-letter characters are called symbols, and they are treated in a different way from those that are similar to identifiers. The lexer follows rules familiar from languages like Haskell, C, and Java, including longest match and spacing conventions.

The reserved words used in HAL/S are the following:

ABS	ABVAL	ACCESS
AFTER	ALIGNED	AND
ARCCOS	ARCCOSH	ARCSIN
ARCSINH	ARCTAN	ARCTAN2
ARCTANH	ARRAY	ASSIGN
AT	AUTOMATIC	BIN
BIT	BOOLEAN	BY
CALL	CANCEL	CASE
CAT	CEILING	CHAR
CHARACTER	CLOCKTIME	CLOSE
COLUMN	COMPOOL	CONSTANT
COS	COSH	DATE
DEC	DECLARE	DENSE
DEPENDENT	DET	DIV
DO	DOUBLE	ELSE
END	EQUATE	ERRGRP
ERRNUM	ERROR	EVENT
EVERY	EXCLUSIVE	EXIT
EXP	EXTERNAL	FALSE
FILE	FLOOR	FOR
FUNCTION	GO	HEX
IF	IGNORE	IN
INDEX	INITIAL	INTEGER
INVERSE	LATCHED	LENGTH
LINE	LJUST	LOCK
LOG	MATRIX	MAX
MIDVAL	MIN	MOD
NAME	NEXTIME	NONHAL
NOT	NULL	OCT
ODD	OFF	ON
OR	PAGE	PRIO
PRIORITY	PROCEDURE	PROD
PROGRAM	RANDOM	RANDOMG
READ	READALL	REENTRANT
REMAINDER	REMOTE	REPEAT
REPLACE	RESET	RETURN
RIGID	RJUST	ROUND
RUNTIME	SCALAR	SCHEDULE
SEND	SET	SHL
SHR	SIGN	SIGNAL
SIGNUM	SIN	SINGLE
SINH	SIZE	SKIP
SQRT	STATIC	STRUCTURE
SUBBIT	SUM	SYSTEM
TAB	TAN	TANH
TASK	TEMPORARY	TERMINATE
THEN	TO	TRACE
TRANSPPOSE	TRIM	TRUE
TRUNCATE	UNIT	UNTIL
UPDATE	VECTOR	WAIT
WHILE	WRITE	XOR
initialized	typeof	typeofv

The symbols used in HAL/S are the following:

```

,      )      (
/      +      -
*      .      **T
**     #      [
]      {      }
$      @      ;
:      |      &
||     ~      <
=      >      %

```

Comments

There are no single-line comments in the grammar.
Multiple-line comments are enclosed with `/*` and `*/`.

The syntactic structure of HAL/S

Non-terminals are enclosed between `<` and `>`. The symbols `::=` (production), `|` (union) and `ε` (empty rule) belong to the BNF notation. All other symbols are terminals.

```

<DECLARE-BODY> ::= <DECLARATION-LIST>
                  | <ATTRIBUTES> , <DECLARATION-LIST>

<ATTRIBUTES> ::= <ARRAY-SPEC> <TYPE-AND-MINOR-ATTR>
                  | <ARRAY-SPEC>
                  | <TYPE-AND-MINOR-ATTR>

<DECLARATION> ::= <NAME-ID>
                  | <NAME-ID> <ATTRIBUTES>
                  | <LabelToken>
                  | <LabelToken> <TYPE-AND-MINOR-ATTR>
                  | <LabelToken> PROCEDURE <MINOR-ATTR-LIST>
                  | <LabelToken> PROCEDURE
                  | <LabelToken> FUNCTION <TYPE-AND-MINOR-ATTR>
                  | <NoArgUserFuncIdentifierToken> FUNCTION <TYPE-AND-MINOR-ATTR>
                  | <LabelToken> FUNCTION
                  | <NoArgUserFuncIdentifierToken> FUNCTION
                  | <EventToken> EVENT
                  | <EventToken> EVENT <MINOR-ATTR-LIST>
                  | <EventToken>
                  | <EventToken> <MINOR-ATTR-LIST>

<ARRAY-SPEC> ::= <ARRAY-HEAD> <LITERAL-EXP-OR-STAR> )
                  | FUNCTION
                  | PROCEDURE
                  | PROGRAM
                  | TASK

<TYPE-AND-MINOR-ATTR> ::= <TYPE-SPEC>
                          | <TYPE-SPEC> <MINOR-ATTR-LIST>
                          | <MINOR-ATTR-LIST>

<IDENTIFIER> ::= <IdentifierToken>

```

$\langle \text{SQ-DQ-NAME} \rangle ::= \langle \text{DOUBLY-QUAL-NAME-HEAD} \rangle \langle \text{LITERAL-EXP-OR-STAR} \rangle)$
 $\quad \quad \quad | \quad \quad \langle \text{ARITH-CONV} \rangle$

$\langle \text{DOUBLY-QUAL-NAME-HEAD} \rangle ::= \text{VECTOR} ($
 $\quad \quad \quad | \quad \quad \text{MATRIX} (\langle \text{LITERAL-EXP-OR-STAR} \rangle ,$

$\langle \text{ARITH-CONV} \rangle ::= \text{INTEGER}$
 $\quad \quad \quad | \quad \quad \text{SCALAR}$
 $\quad \quad \quad | \quad \quad \text{VECTOR}$
 $\quad \quad \quad | \quad \quad \text{MATRIX}$

$\langle \text{DECLARATION-LIST} \rangle ::= \langle \text{DECLARATION} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{DCL-LIST-COMMA} \rangle \langle \text{DECLARATION} \rangle$

$\langle \text{NAME-ID} \rangle ::= \langle \text{IDENTIFIER} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{IDENTIFIER} \rangle \text{NAME}$
 $\quad \quad \quad | \quad \quad \langle \text{BIT-ID} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{CHAR-ID} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{BitFunctionIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{CharFunctionIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{StructIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{StructFunctionIdentifierToken} \rangle$

$\langle \text{ARITH-EXP} \rangle ::= \langle \text{TERM} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PLUS} \rangle \langle \text{TERM} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{MINUS} \rangle \langle \text{TERM} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{ARITH-EXP} \rangle \langle \text{PLUS} \rangle \langle \text{TERM} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{ARITH-EXP} \rangle \langle \text{MINUS} \rangle \langle \text{TERM} \rangle$

$\langle \text{TERM} \rangle ::= \langle \text{PRODUCT} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PRODUCT} \rangle / \langle \text{TERM} \rangle$

$\langle \text{PLUS} \rangle ::= +$

$\langle \text{MINUS} \rangle ::= -$

$\langle \text{PRODUCT} \rangle ::= \langle \text{FACTOR} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{FACTOR} \rangle * \langle \text{PRODUCT} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{FACTOR} \rangle . \langle \text{PRODUCT} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{FACTOR} \rangle \langle \text{PRODUCT} \rangle$

$\langle \text{FACTOR} \rangle ::= \langle \text{PRIMARY} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PRIMARY} \rangle \langle \text{EXPONENTIATION} \rangle \langle \text{FACTOR} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PRIMARY} \rangle **T$

$\langle \text{EXPONENTIATION} \rangle ::= **$

$\langle \text{PRIMARY} \rangle ::= \langle \text{ARITH-VAR} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PRE-PRIMARY} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{MODIFIED-ARITH-FUNC} \rangle$
 $\quad \quad \quad | \quad \quad \langle \text{PRE-PRIMARY} \rangle \langle \text{QUALIFIER} \rangle$

$\langle \text{ARITH-VAR} \rangle ::= \langle \text{ARITH-ID} \rangle$
 $\quad \quad \quad | \langle \text{ARITH-ID} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | [\langle \text{ARITH-ID} \rangle]$
 $\quad \quad \quad | [\langle \text{ARITH-ID} \rangle] \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \{ \langle \text{QUAL-STRUCT} \rangle \}$
 $\quad \quad \quad | \{ \langle \text{QUAL-STRUCT} \rangle \} \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{ARITH-ID} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{ARITH-ID} \rangle \langle \text{SUBSCRIPT} \rangle$

$\langle \text{PRE-PRIMARY} \rangle ::= (\langle \text{ARITH-EXP} \rangle)$
 $\quad \quad \quad | \langle \text{NUMBER} \rangle$
 $\quad \quad \quad | \langle \text{COMPOUND-NUMBER} \rangle$
 $\quad \quad \quad | \langle \text{ARITH-FUNC} \rangle (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | \text{typeof} (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | \text{typeofv} (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | \langle \text{SHAPING-HEAD} \rangle)$
 $\quad \quad \quad | \langle \text{SHAPING-HEAD} \rangle , *)$
 $\quad \quad \quad | \langle \text{LabelToken} \rangle (\langle \text{CALL-LIST} \rangle)$

$\langle \text{NUMBER} \rangle ::= \langle \text{SIMPLE-NUMBER} \rangle$
 $\quad \quad \quad | \langle \text{LEVEL} \rangle$

$\langle \text{LEVEL} \rangle ::= \langle \text{LevelToken} \rangle$

$\langle \text{COMPOUND-NUMBER} \rangle ::= \langle \text{CompoundToken} \rangle$

$\langle \text{SIMPLE-NUMBER} \rangle ::= \langle \text{NumberToken} \rangle$

$\langle \text{MODIFIED-ARITH-FUNC} \rangle ::= \langle \text{NO-ARG-ARITH-FUNC} \rangle$
 $\quad \quad \quad | \langle \text{NO-ARG-ARITH-FUNC} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{NO-ARG-ARITH-FUNC} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{NO-ARG-ARITH-FUNC} \rangle \langle \text{SUBSCRIPT} \rangle$

$\langle \text{SHAPING-HEAD} \rangle ::= \text{INTEGER} (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{SCALAR} (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{VECTOR} (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{MATRIX} (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{INTEGER} \langle \text{SUBSCRIPT} \rangle (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{SCALAR} \langle \text{SUBSCRIPT} \rangle (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{VECTOR} \langle \text{SUBSCRIPT} \rangle (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \text{MATRIX} \langle \text{SUBSCRIPT} \rangle (\langle \text{REPEATED-CONSTANT} \rangle$
 $\quad \quad \quad | \langle \text{SHAPING-HEAD} \rangle , \langle \text{REPEATED-CONSTANT} \rangle$

$\langle \text{CALL-LIST} \rangle ::= \langle \text{LIST-EXP} \rangle$
 $\quad \quad \quad | \langle \text{CALL-LIST} \rangle , \langle \text{LIST-EXP} \rangle$

$\langle \text{LIST-EXP} \rangle ::= \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \langle \text{ARITH-EXP} \rangle \# \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle$

$\langle \text{EXPRESSION} \rangle ::= \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \langle \text{BIT-EXP} \rangle$
 $\quad \quad \quad | \langle \text{CHAR-EXP} \rangle$
 $\quad \quad \quad | \langle \text{NAME-EXP} \rangle$
 $\quad \quad \quad | \langle \text{STRUCTURE-EXP} \rangle$

$$\begin{aligned}
 \langle \textit{ARITH-ID} \rangle &::= \langle \textit{IDENTIFIER} \rangle \\
 &| \langle \textit{ArithFieldToken} \rangle \\
 \langle \textit{NO-ARG-ARITH-FUNC} \rangle &::= \langle \textit{NoArgUserFuncIdentifierToken} \rangle \\
 &| \textit{CLOCKTIME} \\
 &| \textit{DATE} \\
 &| \textit{ERRGRP} \\
 &| \textit{ERRNUM} \\
 &| \textit{PRIO} \\
 &| \textit{RANDOM} \\
 &| \textit{RANDOMG} \\
 &| \textit{RUNTIME}
 \end{aligned}$$

$\langle ARITH-FUNC \rangle$::=	NEXTIME
		ABS
		CEILING
		DIV
		FLOOR
		MIDVAL
		MOD
		REMAINDER
		ROUND
		SIGN
		SIGNUM
		TRUNCATE
		ARCCOS
		ARCCOSH
		ARCSIN
		ARCSINH
		ARCTAN2
		ARCTAN
		ARCTANH
		COS
		COSH
		EXP
		LOG
		SIN
		SINH
		SQRT
		TAN
		TANH
		SHL
		SHR
		ABVAL
		DET
		TRACE
		UNIT
		INDEX
		LENGTH
		INVERSE
		TRANSPOSE
		PROD
		SUM
		SIZE
		MAX
		MIN
$\langle BIT-FUNC \rangle$::=	ODD
		XOR
		$\langle BitFunctionIdentifierToken \rangle$
$\langle SUBSCRIPT \rangle$::=	$\langle SUB-HEAD \rangle$)
		$\langle QUALIFIER \rangle$
		\$ $\langle NUMBER \rangle$
		\$ $\langle ARITH-VAR \rangle$

$$\begin{aligned}
\langle \text{QUALIFIER} \rangle & ::= \$ (@ \langle \text{PREC-SPEC} \rangle) \\
& \quad | \$ (\langle \text{SCALE-HEAD} \rangle \langle \text{ARITH-EXP} \rangle) \\
& \quad | \$ (@ \langle \text{PREC-SPEC} \rangle , \langle \text{SCALE-HEAD} \rangle \langle \text{ARITH-EXP} \rangle) \\
& \quad | \$ (@ \langle \text{RADIX} \rangle) \\
\langle \text{SCALE-HEAD} \rangle & ::= @ \\
& \quad | @ @ \\
\langle \text{PREC-SPEC} \rangle & ::= \text{SINGLE} \\
& \quad | \text{DOUBLE} \\
\langle \text{SUB-START} \rangle & ::= \$ (\\
& \quad | \$ (@ \langle \text{PREC-SPEC} \rangle , \\
& \quad | \langle \text{SUB-HEAD} \rangle ; \\
& \quad | \langle \text{SUB-HEAD} \rangle : \\
& \quad | \langle \text{SUB-HEAD} \rangle , \\
\langle \text{SUB-HEAD} \rangle & ::= \langle \text{SUB-START} \rangle \\
& \quad | \langle \text{SUB-START} \rangle \langle \text{SUB} \rangle \\
\langle \text{SUB} \rangle & ::= \langle \text{SUB-EXP} \rangle \\
& \quad | * \\
& \quad | \langle \text{SUB-RUN-HEAD} \rangle \langle \text{SUB-EXP} \rangle \\
& \quad | \langle \text{ARITH-EXP} \rangle \text{ AT } \langle \text{SUB-EXP} \rangle \\
\langle \text{SUB-RUN-HEAD} \rangle & ::= \langle \text{SUB-EXP} \rangle \text{ TO } \\
\langle \text{SUB-EXP} \rangle & ::= \langle \text{ARITH-EXP} \rangle \\
& \quad | \langle \text{POUND-EXPRESSION} \rangle \\
\langle \text{POUND-EXPRESSION} \rangle & ::= \# \\
& \quad | \langle \text{POUND-EXPRESSION} \rangle \langle \text{PLUS} \rangle \langle \text{TERM} \rangle \\
& \quad | \langle \text{POUND-EXPRESSION} \rangle \langle \text{MINUS} \rangle \langle \text{TERM} \rangle \\
\langle \text{BIT-EXP} \rangle & ::= \langle \text{BIT-FACTOR} \rangle \\
& \quad | \langle \text{BIT-EXP} \rangle \langle \text{OR} \rangle \langle \text{BIT-FACTOR} \rangle \\
\langle \text{BIT-FACTOR} \rangle & ::= \langle \text{BIT-CAT} \rangle \\
& \quad | \langle \text{BIT-FACTOR} \rangle \langle \text{AND} \rangle \langle \text{BIT-CAT} \rangle \\
\langle \text{BIT-CAT} \rangle & ::= \langle \text{BIT-PRIM} \rangle \\
& \quad | \langle \text{BIT-CAT} \rangle \langle \text{CAT} \rangle \langle \text{BIT-PRIM} \rangle \\
& \quad | \langle \text{NOT} \rangle \langle \text{BIT-PRIM} \rangle \\
& \quad | \langle \text{BIT-CAT} \rangle \langle \text{CAT} \rangle \langle \text{NOT} \rangle \langle \text{BIT-PRIM} \rangle \\
\langle \text{OR} \rangle & ::= \langle \text{CHAR-VERTICAL-BAR} \rangle \\
& \quad | \text{OR} \\
\langle \text{CHAR-VERTICAL-BAR} \rangle & ::= | \\
\langle \text{AND} \rangle & ::= \& \\
& \quad | \text{AND}
\end{aligned}$$

$\langle \text{BIT-PRIM} \rangle ::= \langle \text{BIT-VAR} \rangle$
 $\quad \quad \quad | \langle \text{LABEL-VAR} \rangle$
 $\quad \quad \quad | \langle \text{EVENT-VAR} \rangle$
 $\quad \quad \quad | \langle \text{BIT-CONST} \rangle$
 $\quad \quad \quad | (\langle \text{BIT-EXP} \rangle)$
 $\quad \quad \quad | \langle \text{SUBBIT-HEAD} \rangle \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \langle \text{BIT-FUNC-HEAD} \rangle (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | \text{initialized} (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | [\langle \text{BIT-VAR} \rangle]$
 $\quad \quad \quad | [\langle \text{BIT-VAR} \rangle] \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \{ \langle \text{BIT-VAR} \rangle \}$
 $\quad \quad \quad | \{ \langle \text{BIT-VAR} \rangle \} \langle \text{SUBSCRIPT} \rangle$
 $\langle \text{CAT} \rangle ::= ||$
 $\quad \quad \quad | \text{CAT}$
 $\langle \text{NOT} \rangle ::= \text{NOT}$
 $\quad \quad \quad | \sim$
 $\langle \text{BIT-VAR} \rangle ::= \langle \text{BIT-ID} \rangle$
 $\quad \quad \quad | \langle \text{BIT-ID} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{BIT-ID} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{BIT-ID} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\langle \text{LABEL-VAR} \rangle ::= \langle \text{LABEL} \rangle$
 $\quad \quad \quad | \langle \text{LABEL} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{LABEL} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{LABEL} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\langle \text{EVENT-VAR} \rangle ::= \langle \text{EVENT} \rangle$
 $\quad \quad \quad | \langle \text{EVENT} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{EVENT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{EVENT} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\langle \text{BIT-CONST-HEAD} \rangle ::= \langle \text{RADIX} \rangle$
 $\quad \quad \quad | \langle \text{RADIX} \rangle (\langle \text{NUMBER} \rangle)$
 $\langle \text{BIT-CONST} \rangle ::= \langle \text{BIT-CONST-HEAD} \rangle \langle \text{CHAR-STRING} \rangle$
 $\quad \quad \quad | \text{TRUE}$
 $\quad \quad \quad | \text{FALSE}$
 $\quad \quad \quad | \text{ON}$
 $\quad \quad \quad | \text{OFF}$
 $\langle \text{RADIX} \rangle ::= \text{HEX}$
 $\quad \quad \quad | \text{OCT}$
 $\quad \quad \quad | \text{BIN}$
 $\quad \quad \quad | \text{DEC}$
 $\langle \text{CHAR-STRING} \rangle ::= \langle \text{StringToken} \rangle$
 $\langle \text{SUBBIT-HEAD} \rangle ::= \langle \text{SUBBIT-KEY} \rangle ($
 $\quad \quad \quad | \langle \text{SUBBIT-KEY} \rangle \langle \text{SUBSCRIPT} \rangle ($
 $\langle \text{SUBBIT-KEY} \rangle ::= \text{SUBBIT}$
 $\langle \text{BIT-FUNC-HEAD} \rangle ::= \langle \text{BIT-FUNC} \rangle$
 $\quad \quad \quad | \text{BIT}$
 $\quad \quad \quad | \text{BIT} \langle \text{SUB-OR-QUALIFIER} \rangle$

$\langle \text{BIT-ID} \rangle ::= \langle \text{BitIdentifierToken} \rangle$

$\langle \text{LABEL} \rangle ::= \langle \text{LabelToken} \rangle$
 $\quad | \quad \langle \text{BitFunctionIdentifierToken} \rangle$
 $\quad | \quad \langle \text{CharFunctionIdentifierToken} \rangle$
 $\quad | \quad \langle \text{StructFunctionIdentifierToken} \rangle$

$\langle \text{EVENT} \rangle ::= \langle \text{EventToken} \rangle$

$\langle \text{SUB-OR-QUALIFIER} \rangle ::= \langle \text{SUBSCRIPT} \rangle$
 $\quad | \quad \langle \text{BIT-QUALIFIER} \rangle$

$\langle \text{BIT-QUALIFIER} \rangle ::= < \$ (@ \langle \text{RADIX} \rangle)$

$\langle \text{CHAR-EXP} \rangle ::= \langle \text{CHAR-PRIM} \rangle$
 $\quad | \quad \langle \text{CHAR-EXP} \rangle \langle \text{CAT} \rangle \langle \text{CHAR-PRIM} \rangle$
 $\quad | \quad \langle \text{CHAR-EXP} \rangle \langle \text{CAT} \rangle \langle \text{ARITH-EXP} \rangle$
 $\quad | \quad \langle \text{ARITH-EXP} \rangle \langle \text{CAT} \rangle \langle \text{ARITH-EXP} \rangle$
 $\quad | \quad \langle \text{ARITH-EXP} \rangle \langle \text{CAT} \rangle \langle \text{CHAR-PRIM} \rangle$

$\langle \text{CHAR-PRIM} \rangle ::= \langle \text{CHAR-VAR} \rangle$
 $\quad | \quad \langle \text{CHAR-CONST} \rangle$
 $\quad | \quad \langle \text{CHAR-FUNC-HEAD} \rangle (\langle \text{CALL-LIST} \rangle)$
 $\quad | \quad (\langle \text{CHAR-EXP} \rangle)$

$\langle \text{CHAR-FUNC-HEAD} \rangle ::= \langle \text{CHAR-FUNC} \rangle$
 $\quad | \quad \text{CHARACTER } \langle \text{SUB-OR-QUALIFIER} \rangle$

$\langle \text{CHAR-VAR} \rangle ::= \langle \text{CHAR-ID} \rangle$
 $\quad | \quad \langle \text{CHAR-ID} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\quad | \quad \langle \text{QUAL-STRUCT} \rangle . \langle \text{CHAR-ID} \rangle$
 $\quad | \quad \langle \text{QUAL-STRUCT} \rangle . \langle \text{CHAR-ID} \rangle \langle \text{SUBSCRIPT} \rangle$

$\langle \text{CHAR-CONST} \rangle ::= \langle \text{CHAR-STRING} \rangle$
 $\quad | \quad \text{CHAR } (\langle \text{NUMBER} \rangle) \langle \text{CHAR-STRING} \rangle$

$\langle \text{CHAR-FUNC} \rangle ::= \text{LJUST}$
 $\quad | \quad \text{RJUST}$
 $\quad | \quad \text{TRIM}$
 $\quad | \quad \langle \text{CharFunctionIdentifierToken} \rangle$
 $\quad | \quad \text{CHARACTER}$

$\langle \text{CHAR-ID} \rangle ::= \langle \text{CharIdentifierToken} \rangle$

$\langle \text{NAME-EXP} \rangle ::= \langle \text{NAME-KEY} \rangle (\langle \text{NAME-VAR} \rangle)$
 $\quad | \quad \text{NULL}$
 $\quad | \quad \langle \text{NAME-KEY} \rangle (\text{NULL})$

$\langle \text{NAME-KEY} \rangle ::= \text{NAME}$

$\langle \text{NAME-VAR} \rangle ::= \langle \text{VARIABLE} \rangle$
 $\quad | \quad \langle \text{MODIFIED-ARITH-FUNC} \rangle$
 $\quad | \quad \langle \text{LABEL-VAR} \rangle$

$\langle \text{VARIABLE} \rangle ::= \langle \text{ARITH-VAR} \rangle$
 $\quad \quad \quad | \langle \text{BIT-VAR} \rangle$
 $\quad \quad \quad | \langle \text{SUBBIT-HEAD} \rangle \langle \text{VARIABLE} \rangle$
 $\quad \quad \quad | \langle \text{CHAR-VAR} \rangle$
 $\quad \quad \quad | \langle \text{NAME-KEY} \rangle (\langle \text{NAME-VAR} \rangle)$
 $\quad \quad \quad | \langle \text{EVENT-VAR} \rangle$
 $\quad \quad \quad | \langle \text{STRUCTURE-VAR} \rangle$
 $\langle \text{STRUCTURE-EXP} \rangle ::= \langle \text{STRUCTURE-VAR} \rangle$
 $\quad \quad \quad | \langle \text{STRUCT-FUNC-HEAD} \rangle (\langle \text{CALL-LIST} \rangle)$
 $\quad \quad \quad | \langle \text{STRUC-INLINE-DEF} \rangle \langle \text{CLOSING} \rangle ;$
 $\quad \quad \quad | \langle \text{STRUC-INLINE-DEF} \rangle \langle \text{BLOCK-BODY} \rangle \langle \text{CLOSING} \rangle ;$
 $\langle \text{STRUCT-FUNC-HEAD} \rangle ::= \langle \text{STRUCT-FUNC} \rangle$
 $\langle \text{STRUCTURE-VAR} \rangle ::= \langle \text{QUAL-STRUCT} \rangle \langle \text{SUBSCRIPT} \rangle$
 $\langle \text{STRUCT-FUNC} \rangle ::= \langle \text{StructFunctionIdentifierToken} \rangle$
 $\langle \text{QUAL-STRUCT} \rangle ::= \langle \text{STRUCTURE-ID} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle . \langle \text{STRUCTURE-ID} \rangle$
 $\langle \text{STRUCTURE-ID} \rangle ::= \langle \text{StructIdentifierToken} \rangle$
 $\langle \text{ASSIGNMENT} \rangle ::= \langle \text{VARIABLE} \rangle \langle \text{EQUALS} \rangle \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \langle \text{VARIABLE} \rangle , \langle \text{ASSIGNMENT} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle \langle \text{EQUALS} \rangle \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \langle \text{QUAL-STRUCT} \rangle , \langle \text{ASSIGNMENT} \rangle$
 $\langle \text{EQUALS} \rangle ::= =$
 $\langle \text{STATEMENT} \rangle ::= \langle \text{BASIC-STATEMENT} \rangle$
 $\quad \quad \quad | \langle \text{OTHER-STATEMENT} \rangle$
 $\quad \quad \quad | \langle \text{INLINE-DEFINITION} \rangle$

```

<BASIC-STATEMENT> ::= <ASSIGNMENT> ;
| <LABEL-DEFINITION> <BASIC-STATEMENT>
| EXIT ;
| EXIT <LABEL> ;
| REPEAT ;
| REPEAT <LABEL> ;
| GO TO <LABEL> ;
| ;
| <CALL-KEY> ;
| <CALL-KEY> ( <CALL-LIST> ) ;
| <CALL-KEY> <ASSIGN> ( <CALL-ASSIGN-LIST> ) ;
| <CALL-KEY> ( <CALL-LIST> ) <ASSIGN> ( <CALL-ASSIGN-LIST> ) ;
| RETURN ;
| RETURN <EXPRESSION> ;
| <DO-GROUP-HEAD> <ENDING> ;
| <READ-KEY> ;
| <READ-PHRASE> ;
| <WRITE-KEY> ;
| <WRITE-PHRASE> ;
| <FILE-EXP> <EQUALS> <EXPRESSION> ;
| <VARIABLE> <EQUALS> <FILE-EXP> ;
| <FILE-EXP> <EQUALS> <QUAL-STRUCT> ;
| <WAIT-KEY> FOR DEPENDENT ;
| <WAIT-KEY> <ARITH-EXP> ;
| <WAIT-KEY> UNTIL <ARITH-EXP> ;
| <WAIT-KEY> FOR <BIT-EXP> ;
| <TERMINATOR> ;
| <TERMINATOR> <TERMINATE-LIST> ;
| UPDATE PRIORITY TO <ARITH-EXP> ;
| UPDATE PRIORITY <LABEL-VAR> TO <ARITH-EXP> ;
| <SCHEDULE-PHRASE> ;
| <SCHEDULE-PHRASE> <SCHEDULE-CONTROL> ;
| <SIGNAL-CLAUSE> ;
| SEND ERROR <SUBSCRIPT> ;
| SEND ERROR ;
| <ON-CLAUSE> ;
| <ON-CLAUSE> AND <SIGNAL-CLAUSE> ;
| OFF ERROR <SUBSCRIPT> ;
| OFF ERROR ;
| <PERCENT-MACRO-NAME> ;
| <PERCENT-MACRO-HEAD> <PERCENT-MACRO-ARG> ) ;

<OTHER-STATEMENT> ::= <IF-STATEMENT>
| <ON-PHRASE> <STATEMENT>
| <LABEL-DEFINITION> <OTHER-STATEMENT>

<IF-STATEMENT> ::= <IF-CLAUSE> <STATEMENT>
| <TRUE-PART> <STATEMENT>

<IF-CLAUSE> ::= <IF> <RELATIONAL-EXP> <THEN>
| <IF> <BIT-EXP> <THEN>

<TRUE-PART> ::= <IF-CLAUSE> <BASIC-STATEMENT> ELSE

<IF> ::= IF

```


$\langle \text{CALL-KEY} \rangle ::= \text{CALL } \langle \text{LABEL-VAR} \rangle$

$\langle \text{ASSIGN} \rangle ::= \text{ASSIGN}$

$\langle \text{CALL-ASSIGN-LIST} \rangle ::= \langle \text{VARIABLE} \rangle$
 $\quad \quad \quad | \quad \langle \text{CALL-ASSIGN-LIST} \rangle , \langle \text{VARIABLE} \rangle$
 $\quad \quad \quad | \quad \langle \text{QUAL-STRUCT} \rangle$
 $\quad \quad \quad | \quad \langle \text{CALL-ASSIGN-LIST} \rangle , \langle \text{QUAL-STRUCT} \rangle$

$\langle \text{DO-GROUP-HEAD} \rangle ::= \text{DO ;}$
 $\quad \quad \quad | \quad \text{DO } \langle \text{FOR-LIST} \rangle ;$
 $\quad \quad \quad | \quad \text{DO } \langle \text{FOR-LIST} \rangle \langle \text{WHILE-CLAUSE} \rangle ;$
 $\quad \quad \quad | \quad \text{DO } \langle \text{WHILE-CLAUSE} \rangle ;$
 $\quad \quad \quad | \quad \text{DO CASE } \langle \text{ARITH-EXP} \rangle ;$
 $\quad \quad \quad | \quad \langle \text{CASE-ELSE} \rangle \langle \text{STATEMENT} \rangle$
 $\quad \quad \quad | \quad \langle \text{DO-GROUP-HEAD} \rangle \langle \text{ANY-STATEMENT} \rangle$
 $\quad \quad \quad | \quad \langle \text{DO-GROUP-HEAD} \rangle \langle \text{TEMPORARY-STMT} \rangle$

$\langle \text{ENDING} \rangle ::= \text{END}$
 $\quad \quad \quad | \quad \text{END } \langle \text{LABEL} \rangle$
 $\quad \quad \quad | \quad \langle \text{LABEL-DEFINITION} \rangle \langle \text{ENDING} \rangle$

$\langle \text{READ-KEY} \rangle ::= \text{READ (} \langle \text{NUMBER} \rangle \text{)}$
 $\quad \quad \quad | \quad \text{READALL (} \langle \text{NUMBER} \rangle \text{)}$

$\langle \text{WRITE-KEY} \rangle ::= \text{WRITE (} \langle \text{NUMBER} \rangle \text{)}$

$\langle \text{READ-PHRASE} \rangle ::= \langle \text{READ-KEY} \rangle \langle \text{READ-ARG} \rangle$
 $\quad \quad \quad | \quad \langle \text{READ-PHRASE} \rangle , \langle \text{READ-ARG} \rangle$

$\langle \text{WRITE-PHRASE} \rangle ::= \langle \text{WRITE-KEY} \rangle \langle \text{WRITE-ARG} \rangle$
 $\quad \quad \quad | \quad \langle \text{WRITE-PHRASE} \rangle , \langle \text{WRITE-ARG} \rangle$

$\langle \text{READ-ARG} \rangle ::= \langle \text{VARIABLE} \rangle$
 $\quad \quad \quad | \quad \langle \text{IO-CONTROL} \rangle$

$\langle \text{WRITE-ARG} \rangle ::= \langle \text{EXPRESSION} \rangle$
 $\quad \quad \quad | \quad \langle \text{IO-CONTROL} \rangle$
 $\quad \quad \quad | \quad \langle \text{StructIdentifierToken} \rangle$

$\langle \text{FILE-EXP} \rangle ::= \langle \text{FILE-HEAD} \rangle , \langle \text{ARITH-EXP} \rangle$

$\langle \text{FILE-HEAD} \rangle ::= \text{FILE (} \langle \text{NUMBER} \rangle$

$\langle \text{IO-CONTROL} \rangle ::= \text{SKIP (} \langle \text{ARITH-EXP} \rangle \text{)}$
 $\quad \quad \quad | \quad \text{TAB (} \langle \text{ARITH-EXP} \rangle \text{)}$
 $\quad \quad \quad | \quad \text{COLUMN (} \langle \text{ARITH-EXP} \rangle \text{)}$
 $\quad \quad \quad | \quad \text{LINE (} \langle \text{ARITH-EXP} \rangle \text{)}$
 $\quad \quad \quad | \quad \text{PAGE (} \langle \text{ARITH-EXP} \rangle \text{)}$

$\langle \text{WAIT-KEY} \rangle ::= \text{WAIT}$

$\langle \text{TERMINATOR} \rangle ::= \text{TERMINATE}$
 $\quad \quad \quad | \quad \text{CANCEL}$

$\langle \text{TERMINATE-LIST} \rangle ::= \langle \text{LABEL-VAR} \rangle$
 $\quad \quad \quad | \quad \langle \text{TERMINATE-LIST} \rangle , \langle \text{LABEL-VAR} \rangle$

$\langle \text{SCHEDULE-HEAD} \rangle ::= \text{SCHEDULE } \langle \text{LABEL-VAR} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{SCHEDULE-HEAD} \rangle \text{ AT } \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{SCHEDULE-HEAD} \rangle \text{ IN } \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{SCHEDULE-HEAD} \rangle \text{ ON } \langle \text{BIT-EXP} \rangle$
 $\langle \text{SCHEDULE-PHRASE} \rangle ::= \langle \text{SCHEDULE-HEAD} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{SCHEDULE-HEAD} \rangle \text{ PRIORITY } (\langle \text{ARITH-EXP} \rangle)$
 $\quad \quad \quad | \quad \quad \quad \langle \text{SCHEDULE-PHRASE} \rangle \text{ DEPENDENT}$
 $\langle \text{SCHEDULE-CONTROL} \rangle ::= \langle \text{STOPPING} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{TIMING} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{TIMING} \rangle \langle \text{STOPPING} \rangle$
 $\langle \text{TIMING} \rangle ::= \langle \text{REPEAT} \rangle \text{ EVERY } \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{REPEAT} \rangle \text{ AFTER } \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{REPEAT} \rangle$
 $\langle \text{REPEAT} \rangle ::= , \text{ REPEAT}$
 $\langle \text{STOPPING} \rangle ::= \langle \text{WHILE-KEY} \rangle \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{WHILE-KEY} \rangle \langle \text{BIT-EXP} \rangle$
 $\langle \text{SIGNAL-CLAUSE} \rangle ::= \text{SET } \langle \text{EVENT-VAR} \rangle$
 $\quad \quad \quad | \quad \quad \quad \text{RESET } \langle \text{EVENT-VAR} \rangle$
 $\quad \quad \quad | \quad \quad \quad \text{SIGNAL } \langle \text{EVENT-VAR} \rangle$
 $\langle \text{PERCENT-MACRO-NAME} \rangle ::= \% \langle \text{IDENTIFIER} \rangle$
 $\langle \text{PERCENT-MACRO-HEAD} \rangle ::= \langle \text{PERCENT-MACRO-NAME} \rangle ($
 $\quad \quad \quad | \quad \quad \quad \langle \text{PERCENT-MACRO-HEAD} \rangle \langle \text{PERCENT-MACRO-ARG} \rangle ,$
 $\langle \text{PERCENT-MACRO-ARG} \rangle ::= \langle \text{NAME-VAR} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{CONSTANT} \rangle$
 $\langle \text{CASE-ELSE} \rangle ::= \text{DO CASE } \langle \text{ARITH-EXP} \rangle ; \text{ ELSE}$
 $\langle \text{WHILE-KEY} \rangle ::= \text{WHILE}$
 $\quad \quad \quad | \quad \quad \quad \text{UNTIL}$
 $\langle \text{WHILE-CLAUSE} \rangle ::= \langle \text{WHILE-KEY} \rangle \langle \text{BIT-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{WHILE-KEY} \rangle \langle \text{RELATIONAL-EXP} \rangle$
 $\langle \text{FOR-LIST} \rangle ::= \langle \text{FOR-KEY} \rangle \langle \text{ARITH-EXP} \rangle \langle \text{ITERATION-CONTROL} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{FOR-KEY} \rangle \langle \text{ITERATION-BODY} \rangle$
 $\langle \text{ITERATION-BODY} \rangle ::= \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{ITERATION-BODY} \rangle , \langle \text{ARITH-EXP} \rangle$
 $\langle \text{ITERATION-CONTROL} \rangle ::= \text{TO } \langle \text{ARITH-EXP} \rangle$
 $\quad \quad \quad | \quad \quad \quad \text{TO } \langle \text{ARITH-EXP} \rangle \text{ BY } \langle \text{ARITH-EXP} \rangle$
 $\langle \text{FOR-KEY} \rangle ::= \text{FOR } \langle \text{ARITH-VAR} \rangle \langle \text{EQUALS} \rangle$
 $\quad \quad \quad | \quad \quad \quad \text{FOR TEMPORARY } \langle \text{IDENTIFIER} \rangle =$
 $\langle \text{TEMPORARY-STMT} \rangle ::= \text{TEMPORARY } \langle \text{DECLARE-BODY} \rangle ;$
 $\langle \text{CONSTANT} \rangle ::= \langle \text{NUMBER} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{COMPOUND-NUMBER} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{BIT-CONST} \rangle$
 $\quad \quad \quad | \quad \quad \quad \langle \text{CHAR-CONST} \rangle$

$\langle \text{ARRAY-HEAD} \rangle ::= \text{ARRAY (}$
 $\quad | \quad \langle \text{ARRAY-HEAD} \rangle \langle \text{LITERAL-EXP-OR-STAR} \rangle ,$
 $\langle \text{MINOR-ATTR-LIST} \rangle ::= \langle \text{MINOR-ATTRIBUTE} \rangle$
 $\quad | \quad \langle \text{MINOR-ATTR-LIST} \rangle \langle \text{MINOR-ATTRIBUTE} \rangle$
 $\langle \text{MINOR-ATTRIBUTE} \rangle ::= \text{STATIC}$
 $\quad | \quad \text{AUTOMATIC}$
 $\quad | \quad \text{DENSE}$
 $\quad | \quad \text{ALIGNED}$
 $\quad | \quad \text{ACCESS}$
 $\quad | \quad \text{LOCK (} \langle \text{LITERAL-EXP-OR-STAR} \rangle \text{)}$
 $\quad | \quad \text{REMOTE}$
 $\quad | \quad \text{RIGID}$
 $\quad | \quad \langle \text{INIT-OR-CONST-HEAD} \rangle \langle \text{REPEATED-CONSTANT} \rangle \text{)}$
 $\quad | \quad \langle \text{INIT-OR-CONST-HEAD} \rangle * \text{)}$
 $\quad | \quad \text{LATCHED}$
 $\quad | \quad \text{NONHAL (} \langle \text{LEVEL} \rangle \text{)}$
 $\langle \text{INIT-OR-CONST-HEAD} \rangle ::= \text{INITIAL (}$
 $\quad | \quad \text{CONSTANT (}$
 $\quad | \quad \langle \text{INIT-OR-CONST-HEAD} \rangle \langle \text{REPEATED-CONSTANT} \rangle ,$
 $\langle \text{REPEATED-CONSTANT} \rangle ::= \langle \text{EXPRESSION} \rangle$
 $\quad | \quad \langle \text{REPEAT-HEAD} \rangle \langle \text{VARIABLE} \rangle$
 $\quad | \quad \langle \text{REPEAT-HEAD} \rangle \langle \text{CONSTANT} \rangle$
 $\quad | \quad \langle \text{NESTED-REPEAT-HEAD} \rangle \langle \text{REPEATED-CONSTANT} \rangle \text{)}$
 $\quad | \quad \langle \text{REPEAT-HEAD} \rangle$
 $\langle \text{REPEAT-HEAD} \rangle ::= \langle \text{ARITH-EXP} \rangle \#$
 $\langle \text{NESTED-REPEAT-HEAD} \rangle ::= \langle \text{REPEAT-HEAD} \rangle ($
 $\quad | \quad \langle \text{NESTED-REPEAT-HEAD} \rangle \langle \text{REPEATED-CONSTANT} \rangle ,$
 $\langle \text{DCL-LIST-COMMA} \rangle ::= \langle \text{DECLARATION-LIST} \rangle ,$
 $\langle \text{LITERAL-EXP-OR-STAR} \rangle ::= \langle \text{ARITH-EXP} \rangle$
 $\quad | \quad *$
 $\langle \text{TYPE-SPEC} \rangle ::= \langle \text{STRUCT-SPEC} \rangle$
 $\quad | \quad \langle \text{BIT-SPEC} \rangle$
 $\quad | \quad \langle \text{CHAR-SPEC} \rangle$
 $\quad | \quad \langle \text{ARITH-SPEC} \rangle$
 $\quad | \quad \text{EVENT}$
 $\langle \text{BIT-SPEC} \rangle ::= \text{BOOLEAN}$
 $\quad | \quad \text{BIT (} \langle \text{LITERAL-EXP-OR-STAR} \rangle \text{)}$
 $\langle \text{CHAR-SPEC} \rangle ::= \text{CHARACTER (} \langle \text{LITERAL-EXP-OR-STAR} \rangle \text{)}$
 $\langle \text{STRUCT-SPEC} \rangle ::= \langle \text{STRUCT-TEMPLATE} \rangle \langle \text{STRUCT-SPEC-BODY} \rangle$
 $\langle \text{STRUCT-SPEC-BODY} \rangle ::= - \text{STRUCTURE}$
 $\quad | \quad \langle \text{STRUCT-SPEC-HEAD} \rangle \langle \text{LITERAL-EXP-OR-STAR} \rangle \text{)}$
 $\langle \text{STRUCT-TEMPLATE} \rangle ::= \langle \text{STRUCTURE-ID} \rangle$

$\langle \text{STRUCT-SPEC-HEAD} \rangle ::= - \text{STRUCTURE} ($
 $\langle \text{ARITH-SPEC} \rangle ::= \langle \text{PREC-SPEC} \rangle$
 $\quad | \quad \langle \text{SQ-DQ-NAME} \rangle$
 $\quad | \quad \langle \text{SQ-DQ-NAME} \rangle \langle \text{PREC-SPEC} \rangle$
 $\langle \text{COMPILATION} \rangle ::= \langle \text{ANY-STATEMENT} \rangle$
 $\quad | \quad \langle \text{COMPILATION} \rangle \langle \text{ANY-STATEMENT} \rangle$
 $\quad | \quad \langle \text{DECLARE-STATEMENT} \rangle$
 $\quad | \quad \langle \text{COMPILATION} \rangle \langle \text{DECLARE-STATEMENT} \rangle$
 $\quad | \quad \langle \text{STRUCTURE-STMT} \rangle$
 $\quad | \quad \langle \text{COMPILATION} \rangle \langle \text{STRUCTURE-STMT} \rangle$
 $\quad | \quad \langle \text{REPLACE-STMT} \rangle ;$
 $\quad | \quad \langle \text{COMPILATION} \rangle \langle \text{REPLACE-STMT} \rangle ;$
 $\quad | \quad \langle \text{INIT-OR-CONST-HEAD} \rangle \langle \text{EXPRESSION} \rangle)$
 $\langle \text{BLOCK-DEFINITION} \rangle ::= \langle \text{BLOCK-STMT} \rangle \langle \text{CLOSING} \rangle ;$
 $\quad | \quad \langle \text{BLOCK-STMT} \rangle \langle \text{BLOCK-BODY} \rangle \langle \text{CLOSING} \rangle ;$
 $\langle \text{BLOCK-STMT} \rangle ::= \langle \text{BLOCK-STMT-TOP} \rangle ;$
 $\langle \text{BLOCK-STMT-TOP} \rangle ::= \langle \text{BLOCK-STMT-TOP} \rangle \text{ACCESS}$
 $\quad | \quad \langle \text{BLOCK-STMT-TOP} \rangle \text{RIGID}$
 $\quad | \quad \langle \text{BLOCK-STMT-HEAD} \rangle$
 $\quad | \quad \langle \text{BLOCK-STMT-HEAD} \rangle \text{EXCLUSIVE}$
 $\quad | \quad \langle \text{BLOCK-STMT-HEAD} \rangle \text{REENTRANT}$
 $\langle \text{BLOCK-STMT-HEAD} \rangle ::= \langle \text{LABEL-EXTERNAL} \rangle \text{PROGRAM}$
 $\quad | \quad \langle \text{LABEL-EXTERNAL} \rangle \text{COMPOOL}$
 $\quad | \quad \langle \text{LABEL-DEFINITION} \rangle \text{TASK}$
 $\quad | \quad \langle \text{LABEL-DEFINITION} \rangle \text{UPDATE}$
 $\quad | \quad \text{UPDATE}$
 $\quad | \quad \langle \text{FUNCTION-NAME} \rangle$
 $\quad | \quad \langle \text{FUNCTION-NAME} \rangle \langle \text{FUNC-STMT-BODY} \rangle$
 $\quad | \quad \langle \text{PROCEDURE-NAME} \rangle$
 $\quad | \quad \langle \text{PROCEDURE-NAME} \rangle \langle \text{PROC-STMT-BODY} \rangle$
 $\langle \text{LABEL-EXTERNAL} \rangle ::= \langle \text{LABEL-DEFINITION} \rangle$
 $\quad | \quad \langle \text{LABEL-DEFINITION} \rangle \text{EXTERNAL}$
 $\langle \text{CLOSING} \rangle ::= \text{CLOSE}$
 $\quad | \quad \text{CLOSE} \langle \text{LABEL} \rangle$
 $\quad | \quad \text{CLOSE} \langle \text{NoArgUserFuncIdentifierToken} \rangle$
 $\quad | \quad \langle \text{LABEL-DEFINITION} \rangle \langle \text{CLOSING} \rangle$
 $\langle \text{BLOCK-BODY} \rangle ::= \langle \text{DECLARE-GROUP} \rangle$
 $\quad | \quad \langle \text{ANY-STATEMENT} \rangle$
 $\quad | \quad \langle \text{BLOCK-BODY} \rangle \langle \text{ANY-STATEMENT} \rangle$
 $\langle \text{FUNCTION-NAME} \rangle ::= \langle \text{LABEL-EXTERNAL} \rangle \text{FUNCTION}$
 $\quad | \quad \langle \text{NoArgUserFuncIdentifierToken} \rangle : \text{FUNCTION}$
 $\quad | \quad \langle \text{NoArgUserFuncIdentifierToken} \rangle : \text{EXTERNAL FUNCTION}$
 $\langle \text{PROCEDURE-NAME} \rangle ::= \langle \text{LABEL-EXTERNAL} \rangle \text{PROCEDURE}$
 $\langle \text{FUNC-STMT-BODY} \rangle ::= \langle \text{PARAMETER-LIST} \rangle$
 $\quad | \quad \langle \text{TYPE-SPEC} \rangle$
 $\quad | \quad \langle \text{PARAMETER-LIST} \rangle \langle \text{TYPE-SPEC} \rangle$

$\langle \text{PROC-STMT-BODY} \rangle ::= \langle \text{PARAMETER-LIST} \rangle$
 $\quad \quad \quad | \quad \langle \text{ASSIGN-LIST} \rangle$
 $\quad \quad \quad | \quad \langle \text{PARAMETER-LIST} \rangle \langle \text{ASSIGN-LIST} \rangle$
 $\langle \text{DECLARE-GROUP} \rangle ::= \langle \text{DECLARE-ELEMENT} \rangle$
 $\quad \quad \quad | \quad \langle \text{DECLARE-GROUP} \rangle \langle \text{DECLARE-ELEMENT} \rangle$
 $\langle \text{DECLARE-ELEMENT} \rangle ::= \langle \text{DECLARE-STATEMENT} \rangle$
 $\quad \quad \quad | \quad \langle \text{REPLACE-STMT} \rangle ;$
 $\quad \quad \quad | \quad \langle \text{STRUCTURE-STMT} \rangle$
 $\quad \quad \quad | \quad \text{EQUATE EXTERNAL } \langle \text{IDENTIFIER} \rangle \text{ TO } \langle \text{VARIABLE} \rangle ;$
 $\langle \text{PARAMETER} \rangle ::= \langle \text{IdentifierToken} \rangle$
 $\quad \quad \quad | \quad \langle \text{BitIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \langle \text{CharIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \langle \text{StructIdentifierToken} \rangle$
 $\quad \quad \quad | \quad \langle \text{EventToken} \rangle$
 $\quad \quad \quad | \quad \langle \text{LabelToken} \rangle$
 $\langle \text{PARAMETER-LIST} \rangle ::= \langle \text{PARAMETER-HEAD} \rangle \langle \text{PARAMETER} \rangle)$
 $\langle \text{PARAMETER-HEAD} \rangle ::= ($
 $\quad \quad \quad | \quad \langle \text{PARAMETER-HEAD} \rangle \langle \text{PARAMETER} \rangle ,$
 $\langle \text{DECLARE-STATEMENT} \rangle ::= \text{DECLARE } \langle \text{DECLARE-BODY} \rangle ;$
 $\langle \text{ASSIGN-LIST} \rangle ::= \langle \text{ASSIGN} \rangle \langle \text{PARAMETER-LIST} \rangle$
 $\langle \text{TEXT} \rangle ::= \langle \text{TextToken} \rangle$
 $\langle \text{REPLACE-STMT} \rangle ::= \text{REPLACE } \langle \text{REPLACE-HEAD} \rangle \text{ BY } \langle \text{TEXT} \rangle$
 $\langle \text{REPLACE-HEAD} \rangle ::= \langle \text{IDENTIFIER} \rangle$
 $\quad \quad \quad | \quad \langle \text{IDENTIFIER} \rangle (\langle \text{ARG-LIST} \rangle)$
 $\langle \text{ARG-LIST} \rangle ::= \langle \text{IDENTIFIER} \rangle$
 $\quad \quad \quad | \quad \langle \text{ARG-LIST} \rangle , \langle \text{IDENTIFIER} \rangle$
 $\langle \text{STRUCTURE-STMT} \rangle ::= \text{STRUCTURE } \langle \text{STRUCT-STMT-HEAD} \rangle \langle \text{STRUCT-STMT-TAIL} \rangle$
 $\langle \text{STRUCT-STMT-HEAD} \rangle ::= \langle \text{STRUCTURE-ID} \rangle : \langle \text{LEVEL} \rangle$
 $\quad \quad \quad | \quad \langle \text{STRUCTURE-ID} \rangle \langle \text{MINOR-ATTR-LIST} \rangle : \langle \text{LEVEL} \rangle$
 $\quad \quad \quad | \quad \langle \text{STRUCT-STMT-HEAD} \rangle \langle \text{DECLARATION} \rangle , \langle \text{LEVEL} \rangle$
 $\langle \text{STRUCT-STMT-TAIL} \rangle ::= \langle \text{DECLARATION} \rangle ;$
 $\langle \text{INLINE-DEFINITION} \rangle ::= \langle \text{ARITH-INLINE} \rangle$
 $\quad \quad \quad | \quad \langle \text{BIT-INLINE} \rangle$
 $\quad \quad \quad | \quad \langle \text{CHAR-INLINE} \rangle$
 $\quad \quad \quad | \quad \langle \text{STRUCTURE-EXP} \rangle$
 $\langle \text{ARITH-INLINE} \rangle ::= \langle \text{ARITH-INLINE-DEF} \rangle \langle \text{CLOSING} \rangle ;$
 $\quad \quad \quad | \quad \langle \text{ARITH-INLINE-DEF} \rangle \langle \text{BLOCK-BODY} \rangle \langle \text{CLOSING} \rangle ;$
 $\langle \text{ARITH-INLINE-DEF} \rangle ::= \text{FUNCTION } \langle \text{ARITH-SPEC} \rangle ;$
 $\quad \quad \quad | \quad \text{FUNCTION} ;$

$$\begin{aligned}
\langle \textit{BIT-INLINE} \rangle & ::= \langle \textit{BIT-INLINE-DEF} \rangle \langle \textit{CLOSING} \rangle ; \\
& | \quad \langle \textit{BIT-INLINE-DEF} \rangle \langle \textit{BLOCK-BODY} \rangle \langle \textit{CLOSING} \rangle ; \\
\langle \textit{BIT-INLINE-DEF} \rangle & ::= \text{FUNCTION} \langle \textit{BIT-SPEC} \rangle ; \\
\langle \textit{CHAR-INLINE} \rangle & ::= \langle \textit{CHAR-INLINE-DEF} \rangle \langle \textit{CLOSING} \rangle ; \\
& | \quad \langle \textit{CHAR-INLINE-DEF} \rangle \langle \textit{BLOCK-BODY} \rangle \langle \textit{CLOSING} \rangle ; \\
\langle \textit{CHAR-INLINE-DEF} \rangle & ::= \text{FUNCTION} \langle \textit{CHAR-SPEC} \rangle ; \\
\langle \textit{STRUC-INLINE-DEF} \rangle & ::= \text{FUNCTION} \langle \textit{STRUCT-SPEC} \rangle ;
\end{aligned}$$