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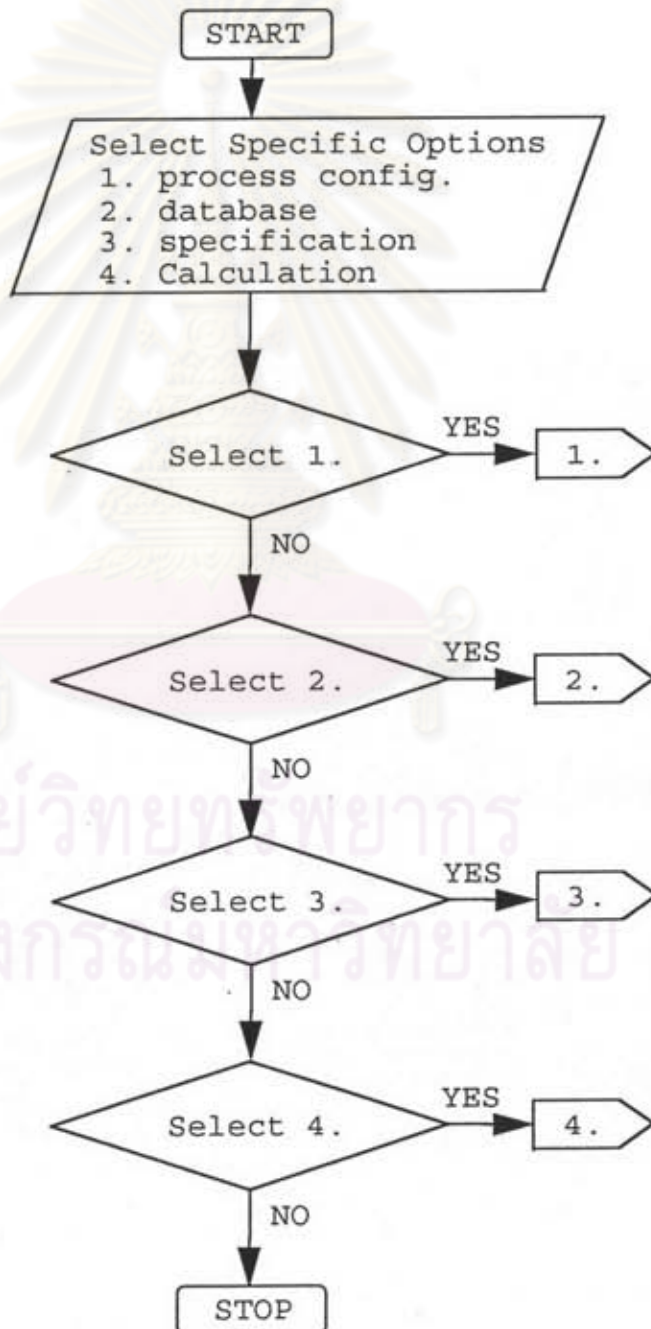
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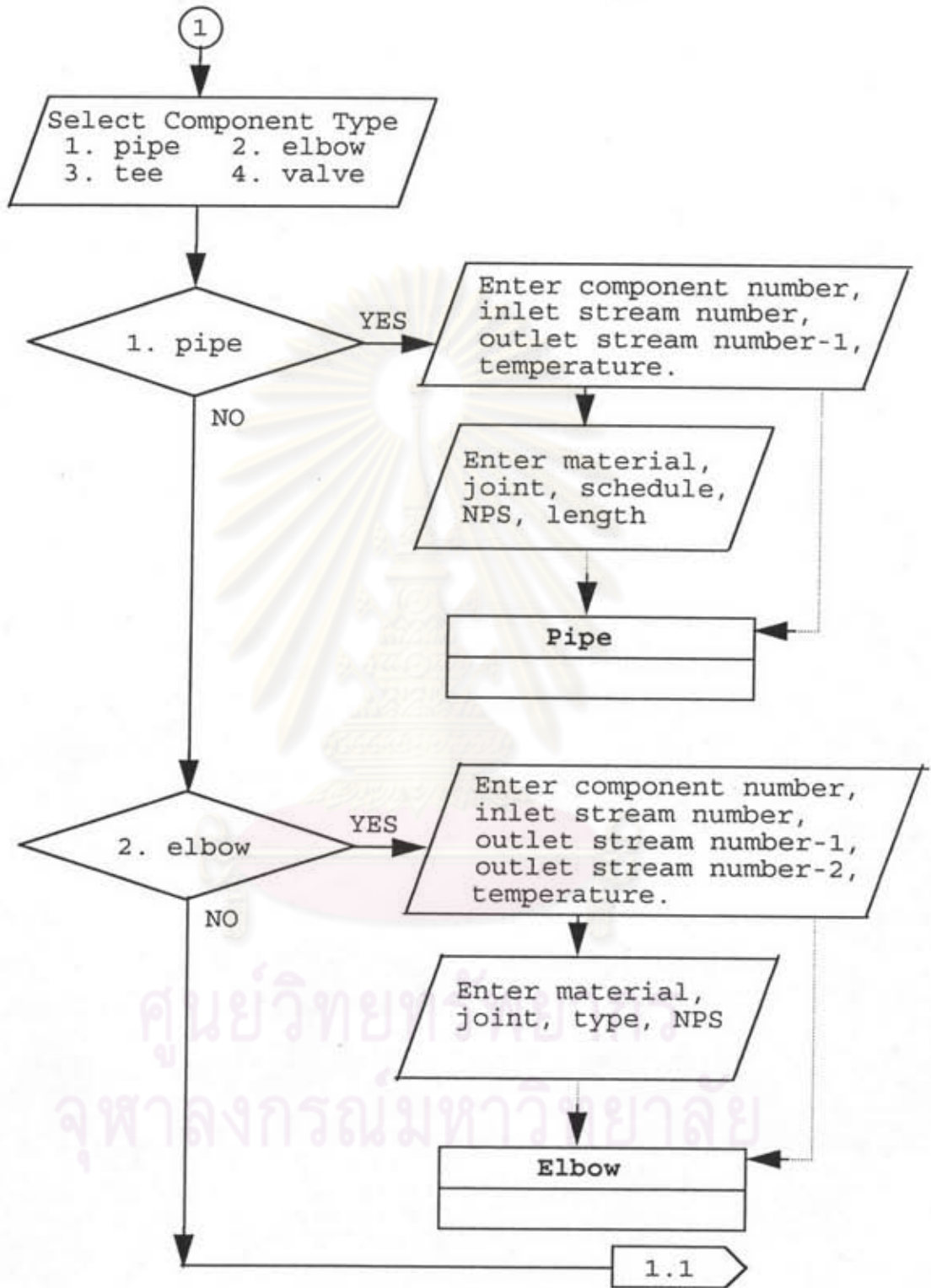
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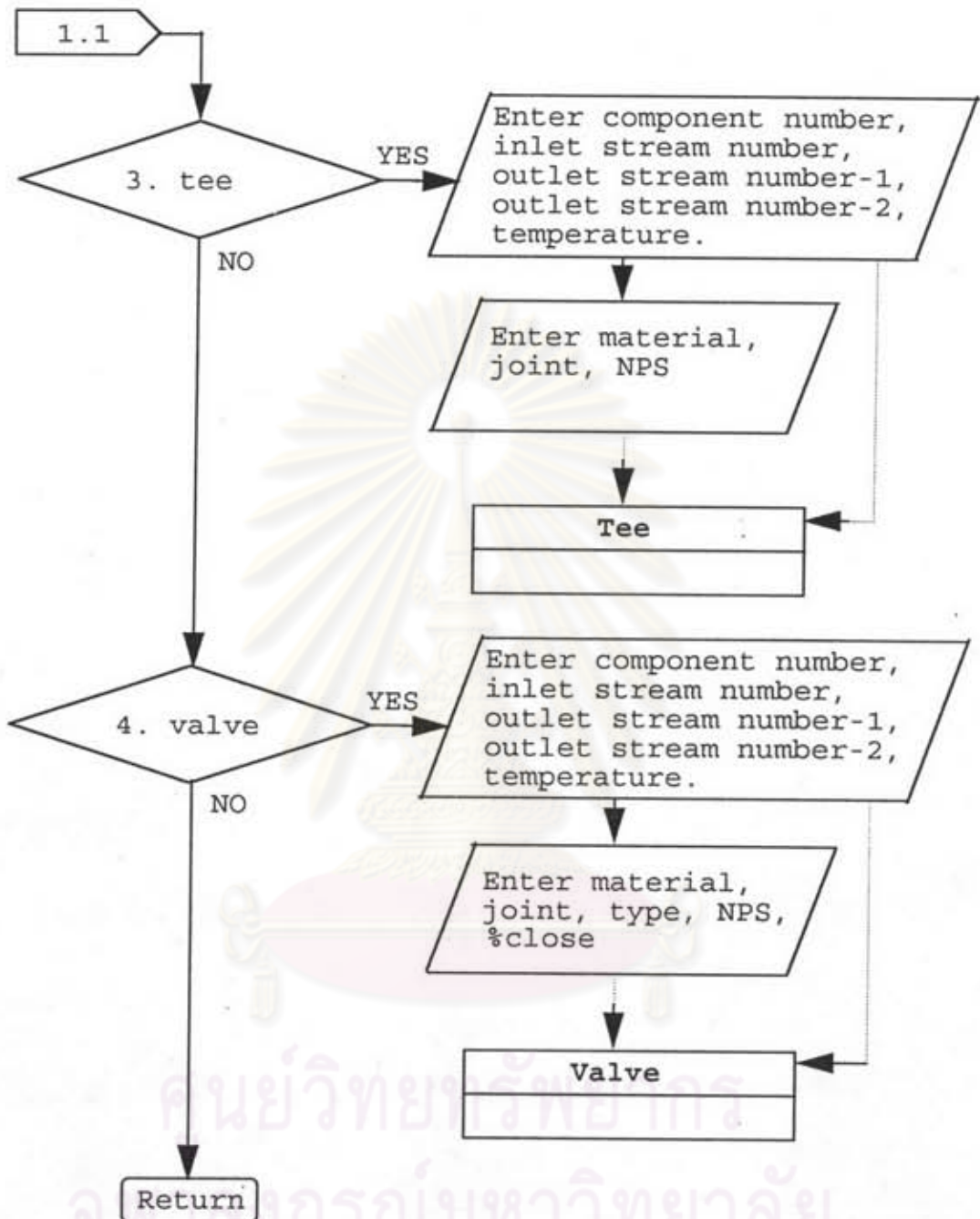
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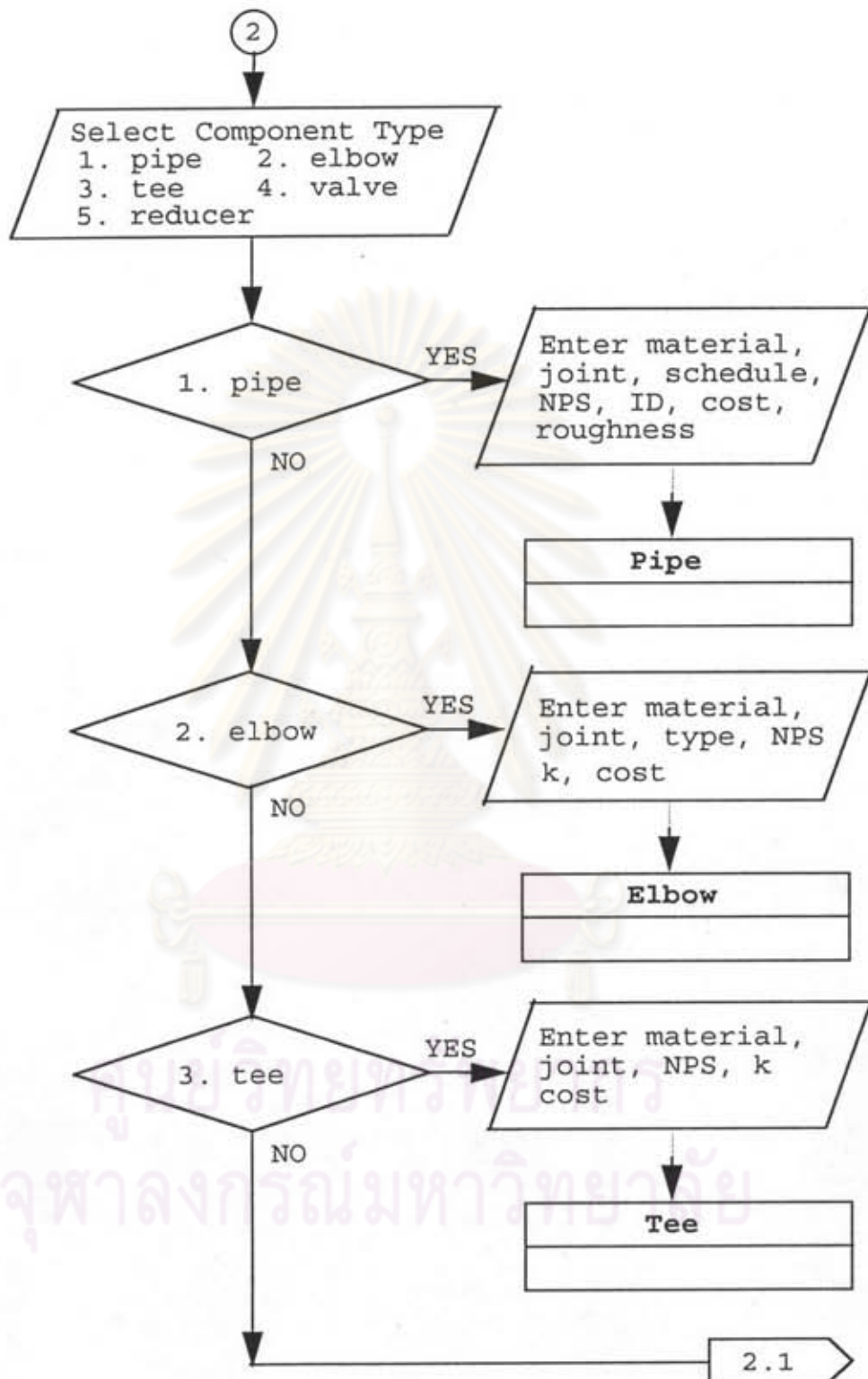
Appendix A

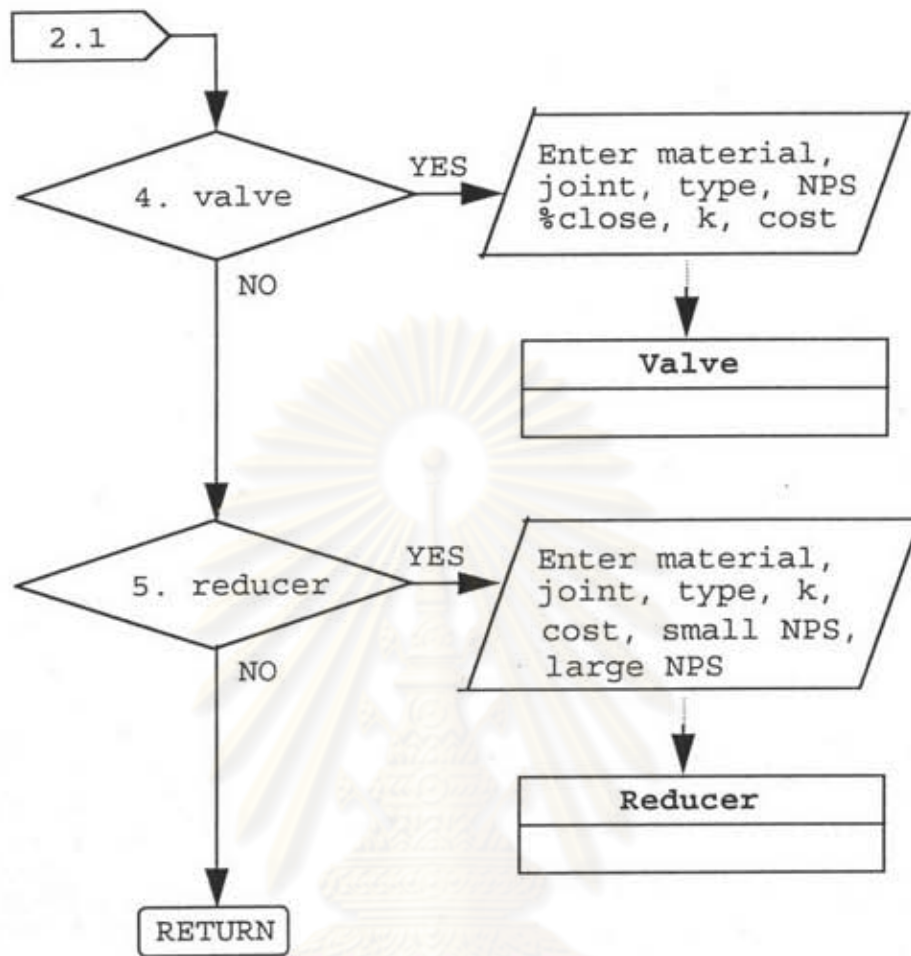
Program Flow Chart



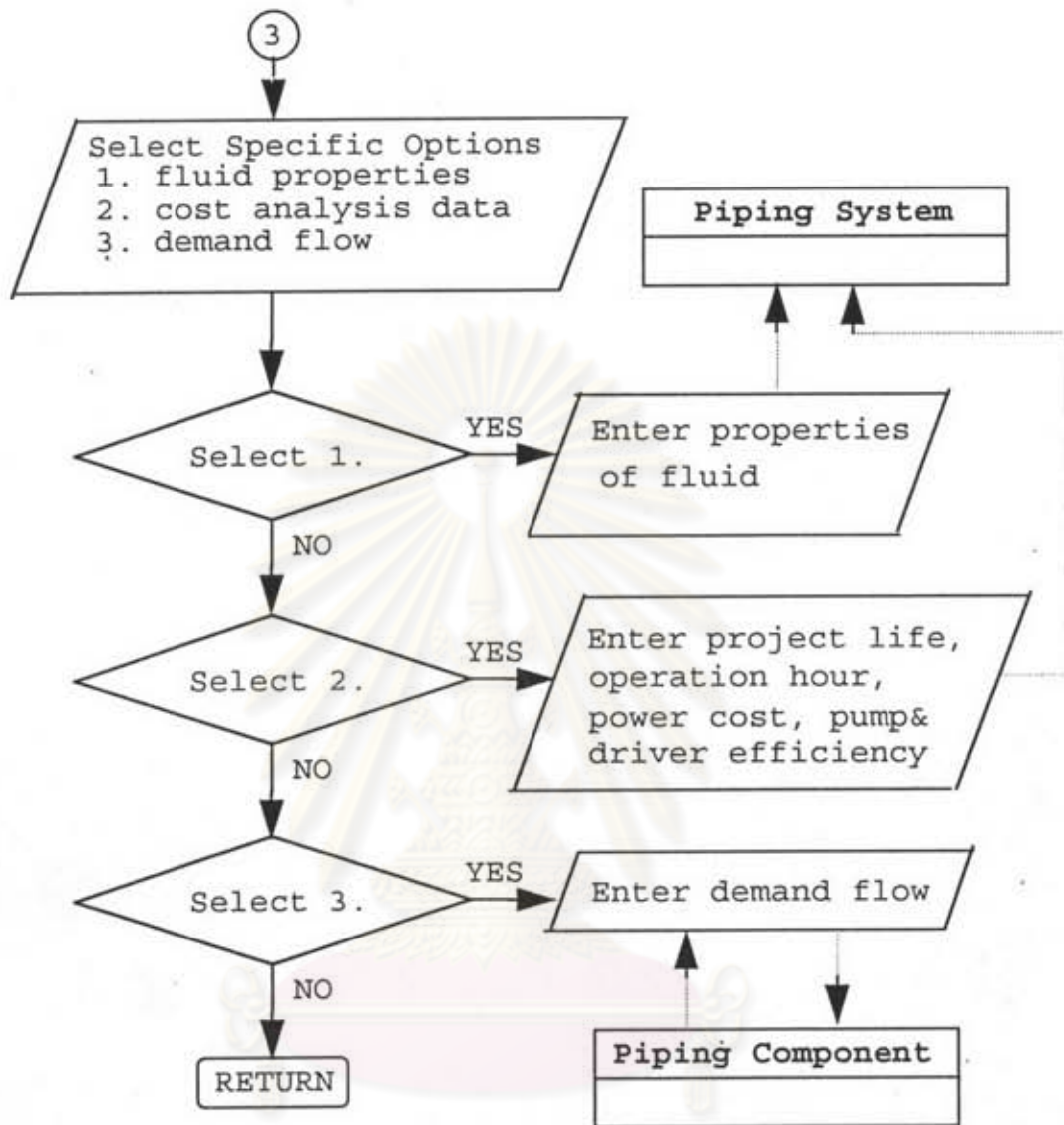




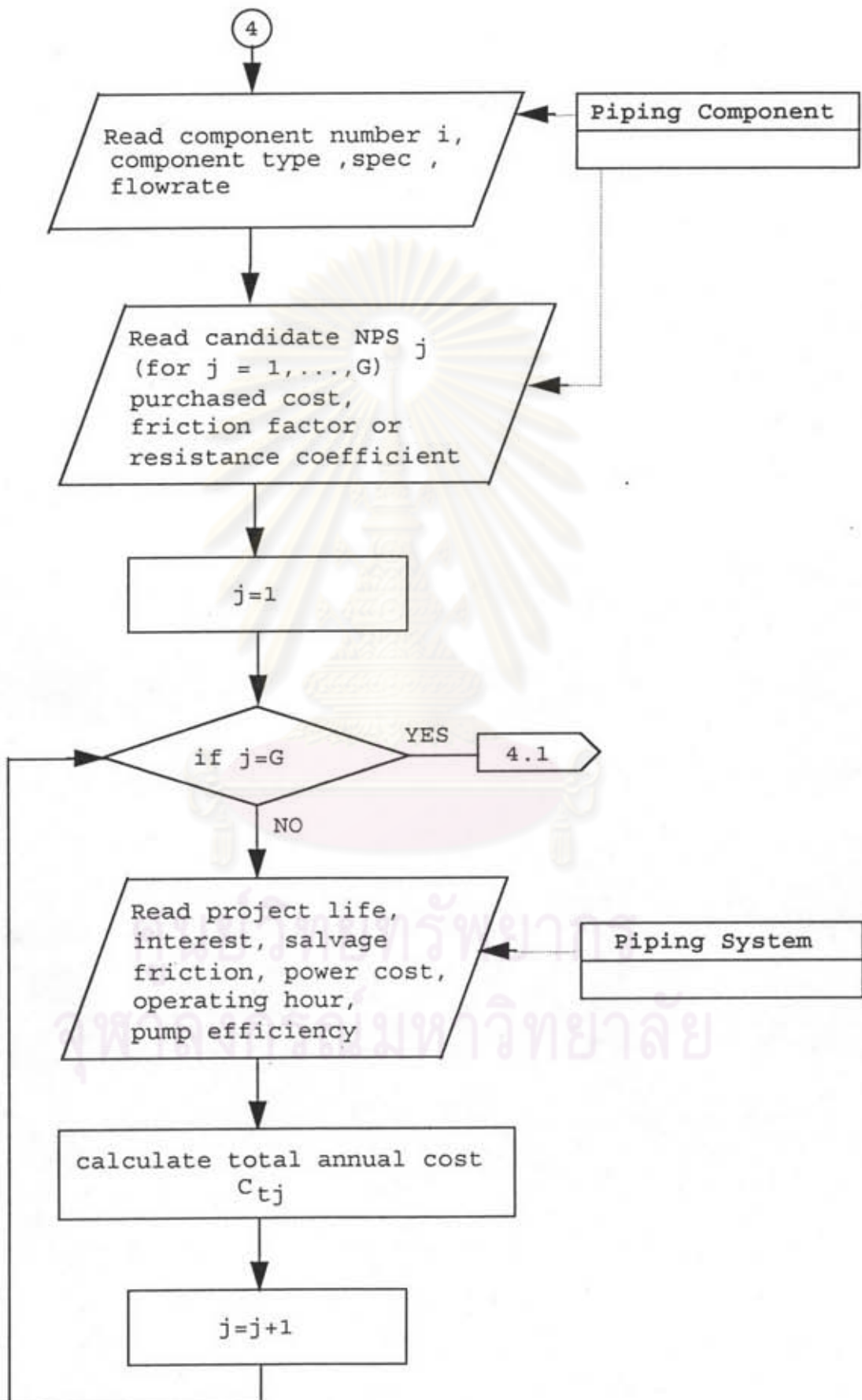


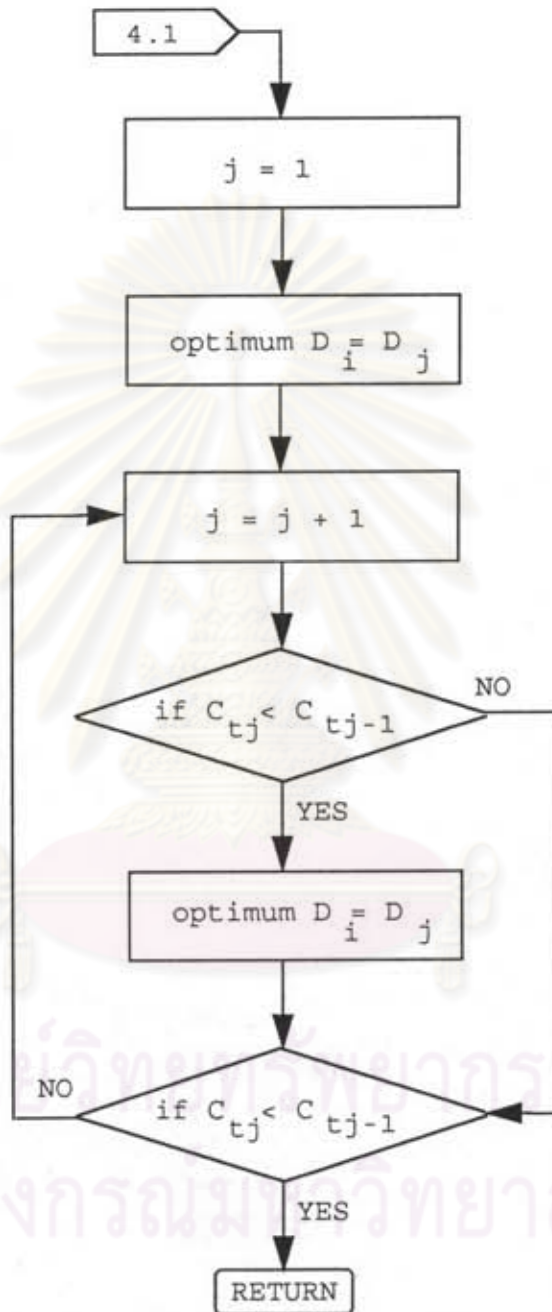


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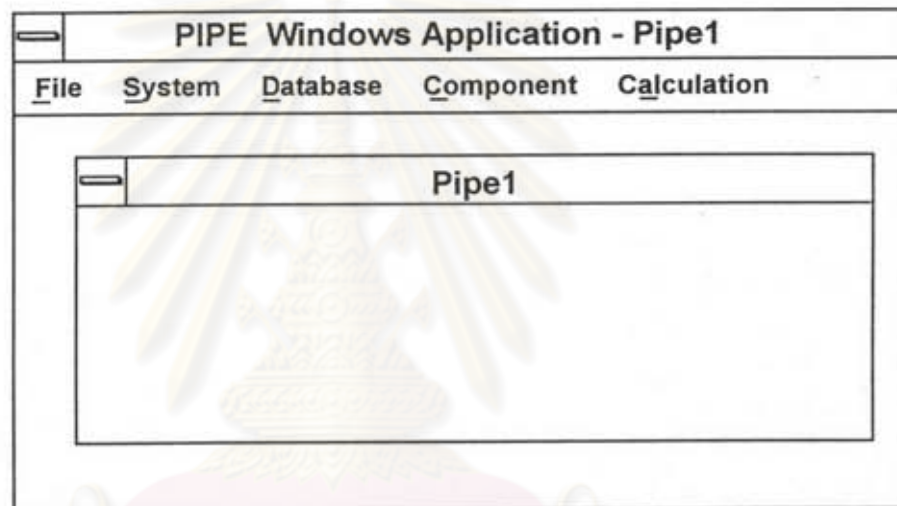




Appendix B

Piping Program Run Test

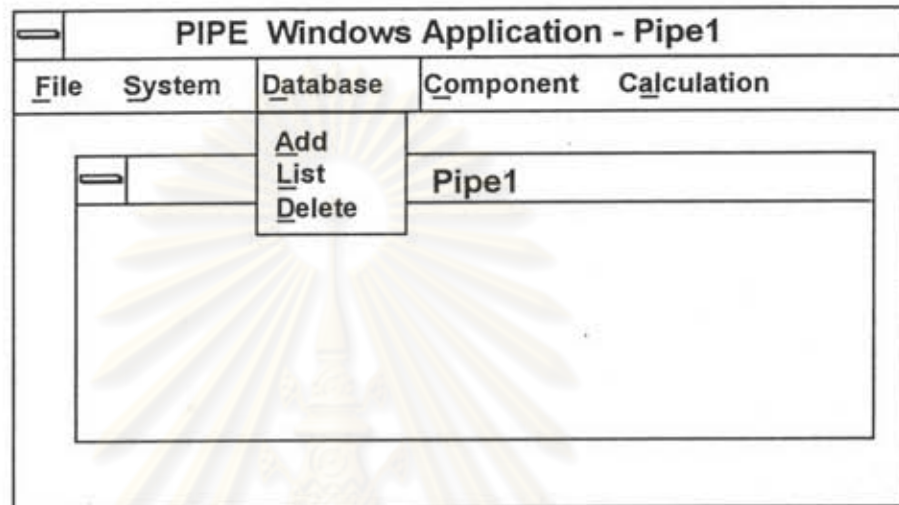
From the development, the piping program will be run on Windows and is started as shown in figure below.



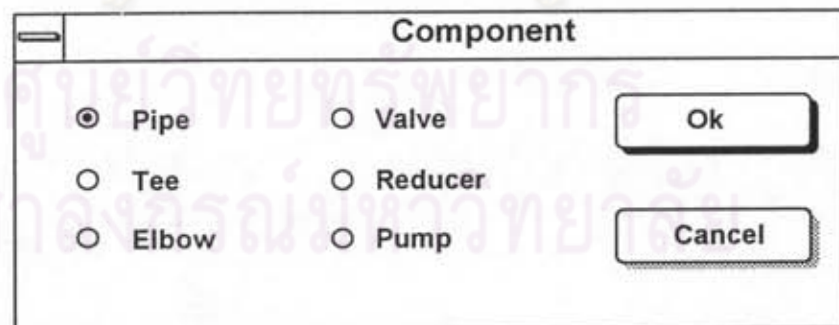
The program menu contains four program functions that are design as program functions in Chap 4. The *System* command is specification function, the *Component* command is process configuration function and the *Database* command is function of pipe, valve and fitting data.

The developed program is mainly support to data of commercial piping component such as pipe, tee, elbow, valve, reducer and pump. For the data management, *Data* command is used to add, delete or list the data. When we

select the *Data* command, the program will show as following figure.



There are three menu items in *Database* command and each of them will be followed by *Component* dialog as shown below.



To illustrate adding pipe data, standard aluminum pipe 2" NPS in Chap5 is used as an example data. From program menu items, *Data*, *Add* and *Pipe* are selected

respectively and then *Pipe* dialog will appear. The pipe data and *Pipe* dialog are shown as following figure.

Pipe		
material	aluminum	Ok
joint	flange	
schedule	40	Cancel
NPS	2	
ID	52.5018	mm
roughness	0.0058	mm
cost	0.83	\$/m

As pipe data adding, data of other components such elbow, tee, valve can be added by their dialogs. The dialogs will be shown as following figures.

Elbow		
material	aluminum	Ok
joint	flange	
type	regular	Cancel
NPS	2	
k	0.39	
cost	1.54	\$/pc

Tee		
material	<input type="text" value="aluminum"/>	<input type="button" value="Ok"/>
joint	<input type="text" value="flange"/>	
type	<input type="text" value="150"/>	<input type="button" value="Cancel"/>
Line K	<input type="text" value="0.19"/>	
Branch K	<input type="text" value="0.8"/>	
cost	<input type="text" value="2.18"/>	\$/pc

Valve		
material	<input type="text" value="aluminum"/>	<input type="button" value="Ok"/>
joint	<input type="text" value="flange"/>	
type	<input type="text" value="globe"/>	<input type="button" value="Cancel"/>
NPS	<input type="text" value="2"/>	in
close	<input type="text" value="75"/>	%
k	<input type="text" value="0.18"/>	
cost	<input type="text" value="5"/>	\$/pc

Reducer		
material	<input type="text" value="aluminum"/>	<input type="button" value="Ok"/>
joint	<input type="text" value="flange"/>	
type	<input type="text" value="eccentric"/>	<input type="button" value="Cancel"/>
Large NPS	<input type="text" value="3"/>	in
Small NPS	<input type="text" value="2"/>	in
k	<input type="text" value="0.04"/>	
cost	<input type="text" value="0.64"/>	\$/pc

Pump			
name	<input type="text" value="special"/>		<input type="button" value="Ok"/>
head	<input type="text" value="60"/>	m	
flowrate	<input type="text" value="0.053"/>	cu m/s	<input type="button" value="Cancel"/>
life	<input type="text" value="5"/>	yr	
cost	<input type="text" value="100"/>	\$/pc	

The data can be shown by using *Data-List* and selecting component type. Dialogs of listing are the same as dialogs for adding that shown above. To delete data of pipe, tee, elbow and valve, *Data-Delete* and *Component* are selected and then the *Delete* dialog will appear as following figure.

Delete			
material	<input type="text" value="aluminum"/>		<input type="button" value="Ok"/>
joint	<input type="text" value="flange"/>		
type	<input type="text" value="regular"/>		<input type="button" value="Cancel"/>
NPS	<input type="text" value="2"/>	in	

However, the above *Delete* dialog is different form *Delete* dialogs of reducer and pump that are shown below.

Delete		
material	<input type="text" value="aluminum"/>	<input type="button" value="Ok"/>
joint	<input type="text" value="flange"/>	
type	<input type="text" value="eccentric"/>	<input type="button" value="Cancel"/>
Large NPS	<input type="text" value="3"/>	in
Small NPS	<input type="text" value="2"/>	in

Delete		
name	<input type="text" value="special"/>	<input type="button" value="Ok"/>
head	<input type="text" value="60"/>	
		<input type="button" value="Cancel"/>

As the *Data* command, the other commands work with pop-up menu and dialog which will be illustrated as following figures.

PIPE Windows Application - Pipe1				
File	System	Database	Component	Calculation
			<input type="button" value="Add"/> <input type="button" value="List"/> <input type="button" value="Delete"/> <input type="button" value="Spec"/>	

Component		
<input checked="" type="radio"/> Pipe	<input type="radio"/> Valve	Ok
<input type="radio"/> Tee	<input type="radio"/> Reducer	
<input type="radio"/> Elbow	<input type="radio"/> Pump	Cancel

Pipe		
component number	<input type="text" value="1"/>	Ok
inlet component	<input type="text" value="0"/>	
outlet component	<input type="text" value="2"/>	Cancel
length	<input type="text" value="60.96"/>	
flowrate	<input type="text" value="0.1151"/>	cu m/s
pressure head	<input type="text" value="0"/>	m
elevation	<input type="text" value="0"/>	m

Elbow		
component number	<input type="text" value="8"/>	Ok
inlet component	<input type="text" value="7"/>	
outlet component	<input type="text" value="9"/>	Cancel
flowrate	<input type="text" value="0.0246"/>	
pressure head	<input type="text" value="0"/>	m
elevation	<input type="text" value="0"/>	m

Tee		
component number	<input type="text" value="2"/>	<input type="button" value="Ok"/>
inlet component	<input type="text" value="1"/>	
line outlet component	<input type="text" value="3"/>	<input type="button" value="Cancel"/>
branch outlet component	<input type="text" value="0"/>	
line flowrate	<input type="text" value="0.1066"/>	cu m/s
branch flowrate	<input type="text" value="0"/>	cu m/s
pressure head	<input type="text" value="0"/>	m
elevation	<input type="text" value="0"/>	m

Valve		
component number	<input type="text" value="45"/>	<input type="button" value="Ok"/>
inlet component	<input type="text" value="44"/>	
outlet component	<input type="text" value="46"/>	<input type="button" value="Cancel"/>
flowrate	<input type="text" value="0.05"/>	cu m/s
pressure head	<input type="text" value="10"/>	m
elevation	<input type="text" value="5"/>	m

Delete		
component number	<input type="text" value="45"/>	<input type="button" value="Ok"/>
		<input type="button" value="Cancel"/>

System Data			
fluid density	<input type="text" value="998"/>	Kg/cu m	
viscosity	<input type="text" value="0.0012"/>	N-s/sq m	
project life	<input type="text" value="10"/>	yr	
interest	<input type="text" value="5"/>	%	
salvage value	<input type="text" value="5"/>	%	<input type="button" value="Ok"/>
operating hour	<input type="text" value="500"/>	hr/yr	
power cost	<input type="text" value="0.000067"/>	\$/w-hr	<input type="button" value="Cancel"/>

Calculation				
component number	optimum NPS	component number	optimum NPS	<input type="button" value="Ok"/>
<input type="text" value="1"/>	<input type="text" value="10"/>	<input type="text" value="15"/>	<input type="text" value="10"/>	
<input type="text" value="2"/>	<input type="text" value="10"/>	<input type="text" value="28"/>	<input type="text" value="10"/>	<input type="button" value="Cancel"/>
<input type="text" value="3"/>	<input type="text" value="10"/>	<input type="text" value="29"/>	<input type="text" value="5"/>	
<input type="text" value="4"/>	<input type="text" value="10"/>	<input type="text" value="30"/>	<input type="text" value="5"/>	
<input type="text" value="5"/>	<input type="text" value="10"/>	<input type="text" value="31"/>	<input type="text" value="5"/>	

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Vita

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